Chemistry
QC
770
.U56

THE UNIVERSITY
OF MICHIGAN
SEP 14 1962
CHEMISTRY
LIBRARY

NUCLEAR SCIENCE ABSTRACTS

Volume 16 Number 16

Abstracts 20041 – 21865

August 31, 1962

UNITED STATES ATOMIC ENERGY COMMISSION
Division of Technical Information

USAEC DEPOSITORY LIBRARIES

Collections of USAEC reports are maintained in the libraries of the organizations listed below for reference use by the general public. Facilities for making photocopies are available. The USAEC also makes available through these libraries atomic energy reports of countries other than the U. S. that are abstracted in *Nuclear Science Abstracts*.

ALABAMA
Auburn, Auburn University
Birmingham, Public Library

ARIZONA
Tucson, University of Arizona

ARKANSAS
Fayetteville, University of Arkansas

CALIFORNIA
Berkeley, University of California
Los Angeles, University of California
Menlo Park, Stanford Research Institute
San Diego, Public Library

COLORADO
Denver, Public Library

CONNECTICUT
New Haven, Yale University

DELAWARE
Newark, University of Delaware

DISTRICT OF COLUMBIA
Washington, Library of Congress

FLORIDA
Coral Gables, University of Miami
Gainesville, University of Florida

GEORGIA
Atlanta, Georgia Institute of Technology

HAWAII
Honolulu, University of Hawaii

ILLINOIS
Chicago, John Crerar Library
Chicago, University of Chicago
Evanston, Northwestern University
Urbana, University of Illinois

INDIANA
Indianapolis, Public Library
Lafayette, Purdue University

IOWA
Ames, Iowa State University

KANSAS
Manhattan, Kansas State University

KENTUCKY
Lexington, University of Kentucky
Louisville, University of Louisville

LOUISIANA
Baton Rouge, Louisiana State University
New Orleans, Tulane University

MARYLAND
Baltimore, Johns Hopkins University
College Park, University of Maryland

MASSACHUSETTS
Cambridge, Harvard University
Cambridge, Massachusetts Institute of Technology

MICHIGAN
Ann Arbor, University of Michigan
Detroit, Public Library

MINNESOTA
Minneapolis, University of Minnesota

MISSOURI
Kansas City, Linda Hall Library
Rolla, University of Missouri School of Mines and Metallurgy
St. Louis, Washington University

MONTANA
Bozeman, Montana State College

NEVADA
Reno, University of Nevada

NEW JERSEY
Princeton, Princeton University

NEW MEXICO
Albuquerque, University of New Mexico

NEW YORK
Buffalo, University of Buffalo
Ithaca, Cornell University
New York, Atomic Industrial Forum, Inc.
New York, Columbia University
New York, Public Library
Rochester, University of Rochester
Schenectady, Union College
Syracuse, Syracuse University
Troy, Rensselaer Polytechnic Institute

NORTH CAROLINA
Charlotte, Charlotte and Mecklenburg County Public Library
Durham, Duke University
Raleigh, North Carolina State College

NORTH DAKOTA
Grand Forks, University of North Dakota

OHIO
Cincinnati, University of Cincinnati
Cleveland, Public Library

OHIO (CONT.)
Columbus, Ohio State University
Toledo, University of Toledo
Youngstown, Youngstown University

OKLAHOMA
Stillwater, Oklahoma State University

OREGON
Corvallis, Oregon State College
Portland, Reed College

PENNSYLVANIA
Philadelphia, University of Pennsylvania
Pittsburgh, Carnegie Library
University Park, Pennsylvania State University

PUERTO RICO
Rio Piedras, University of Puerto Rico

RHODE ISLAND
Providence, Brown University

SOUTH CAROLINA
Columbia, University of South Carolina

TENNESSEE
Knoxville, University of Tennessee
Memphis, Public Library
Nashville, Joint University Libraries

TEXAS
Austin, University of Texas
College Station, Agricultural and Mechanical College of Texas
Dallas, Southern Methodist University
Houston, Rice Institute
San Antonio, Public Library

UTAH
Salt Lake City, University of Utah

VIRGINIA
Blacksburg, Virginia Polytechnic Institute
Charlottesville, University of Virginia

WASHINGTON
Pullman, Washington State University
Seattle, University of Washington

WEST VIRGINIA
Morgantown, West Virginia University

WISCONSIN
Madison, University of Wisconsin
Milwaukee, Public Library

WYOMING
Laramie, University of Wyoming

Volume 16, Number 16 August 31, 1962

NUCLEAR SCIENCE ABSTRACTS

A SEMIMONTHLY PUBLICATION OF THE DIVISION OF TECHNICAL INFORMATION, U. S. ATOMIC ENERGY COMMISSION

Nuclear Science Abstracts is the only comprehensive abstracting and indexing service devoted solely to the literature of nuclear science and technology. Published twice each month since 1947, *NSA* provides coverage of (1) technical reports of the United States Atomic Energy Commission and its contractors; (2) technical reports of government agencies, universities, and industrial and independent research organizations in the United States and abroad, and (3) the book, patent, and journal literature, and translations thereof, on a world-wide basis.

INDEXES

Regular Issues. Each issue of *NSA* includes subject, personal and corporate author, and report number indexes. Report numbers are also indicated in the author and subject indexes. The author indexes include "short titles" of the items indexed. The Report Number Index provides information on the availability of the reports.

Cumulations. The indexes included in the individual issues are cumulated quarterly, semiannually, and annually. A cumulated report number, author, and subject index covering Volumes 1 through 4 (July 1948–1950) is included in the bound Volume 4 which is available from the Johnson Reprint Corporation, 111 Fifth Ave., New York, N. Y. ($30.00). A subject and author index covering Volumes 5 through 10 (1951–1956) is available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. ($5.25).

A cumulative index covering Volumes 11–15 (1957–1961) was issued in early 1962 and is available from the U. S. Government Printing Office, Washington 25, D. C. ($40.25). The four parts of this cumulative index are also available separately as follows: Subject Index ($19.00), Personal Author Index ($14.25), Corporate Author Index ($2.50), and Report Number Index ($4.50). The Report Number Index covers all volumes of *NSA* and has been issued in lieu of report TID-4000, *Public Availability of Reports Abstracted in Nuclear Science Abstracts.*

HOW TO OBTAIN NSA

Subscription. The semimonthly abstract issues and the four cumulated-index issues are available postpaid on subscription and in single copy from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., at the prices indicated below:

- *Semimonthly issues.* Annual subscription rate: $22.00, domestic; $27.50, foreign. Price per single copy: $1.25, domestic; 25 per cent extra for foreign mailing.
- *Cumulated-index issues.* Annual subscription rate: $15.00, domestic; $17.50, foreign. Price per single copy varies according to the number of pages.
- *Domestic subscription rates* apply to the United States, Canada, Mexico, and all Central and South American countries, except as noted below.
- *Foreign subscription rates* apply to Argentina, Brazil, British and French Guiana, Surinam, British Honduras, and all other countries throughout the world.

Exchange. *NSA* is also available on an exchange basis to universities, research institutions, industrial firms, and publishers of scientific information. Inquiries should be directed to the Division of Technical Information Extension, U. S. Atomic Energy Commission, P. O. Box 62, Oak Ridge, Tennessee.

Availability to Government Agencies. *NSA* is available free of charge to all U. S. Government Agencies upon request to the Division of Technical Information Extension, U. S. Atomic Energy Commission, P. O. Box 62, Oak Ridge, Tennessee.

AVAILABILITY OF PUBLICATIONS ABSTRACTED

Public availability of all U. S. Atomic Energy Commission reports is indicated in the Report Number Index. Also included, when known, is the availability of many reports of other government agencies and organizations, both in the United States and abroad.

The availability of certain unnumbered reports abstracted in *NSA* is included in the abstract. The abbreviation GPO indicates that the material is available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

Journal articles, books, and other published materials are available through standard commercial subscriptions or library sources.

Dissertations taken from *Dissertation Abstracts* are available from University Microfilms, Inc., 315 N. First Street, Ann Arbor, Michigan.

The AEC reports listed in this document are accounts of Government sponsored work. Neither the United States, nor the Commission, nor any person acting on behalf of the Commission:

A. Makes any warranty or representation, expressed or implied, with respect to the accuracy, completeness, or usefulness of the information contained in these reports, or that the use of any information, apparatus, method, or process disclosed in these reports may not infringe privately owned rights; or

B. Assumes any liabilities with respect to the use of, or for damages resulting from the use of any information, apparatus, method, or process disclosed in these reports.

As used in the above, "person acting on behalf of the Commission" includes any employee or contractor of the Commission, or employee of such contractor, to the extent that such employee or contractor of the Commission, or employee of such contractor prepares, disseminates, or provides access to, any information pursuant to his employment or contract with the Commission, or his employment with such contractor.

Use of funds for printing this publication has been approved by the Bureau of the Budget, July 29, 1960.

TABLE OF CONTENTS

Volume 16, Number 16, August 31, 1962

Category	*Page*
GENERAL AND MISCELLANEOUS	2603
BIOLOGY AND MEDICINE	2608
General and Miscellaneous	2608
Biochemistry, Nutrition, and Toxicology	2611
Fallout and Ecology	2617
Radiation Effects on Living Tissues	2618
Radiation Sickness	2634
CHEMISTRY	2642
General and Miscellaneous	2642
Analytical Procedures	2643
General Inorganic and Physical Chemistry	2647
Radiation Chemistry and Radiochemistry	2660
Raw Materials and Feed Materials	2669
Separation Processes	2670
ENGINEERING AND EQUIPMENT	2675
General and Miscellaneous	2675
Heat Transfer and Fluid Flow	2678
Instrumentation	2682
Materials Testing	2708
GEOLOGY, MINERALOGY, AND METEOROLOGY	2710
HEALTH AND SAFETY	2715
INDUSTRIAL APPLICATIONS OF ISOTOPES AND RADIATIONS	2722
ISOTOPE SEPARATION	2724
MATHEMATICS AND COMPUTERS	2725
METALS, CERAMICS, AND OTHER MATERIALS	2728
General and Miscellaneous	2728
Corrosion	2730
Fabrication	2733
Properties and Structure	2735
Radiation Effects	2746
PHYSICS	2749
General and Miscellaneous	2749
Astrophysics and Cosmology	2764
Cosmic Radiation	2765
Criticality Studies	2768
Elementary Particles and Radiations	2768
Neutron Physics	2775
Nuclear Properties and Reactions	2777
Particle Accelerators	2810
Plasma Physics and Thermonuclear Processes	2812
Shielding	2816
Theoretical Physics	2817
REACTOR TECHNOLOGY	2820
General and Miscellaneous	2820
Power Reactors	2828
Research Reactors	2833
SPACE APPLICATIONS AND TECHNOLOGY	2835
WASTE DISPOSAL AND PROCESSING	2837
CORPORATE AUTHOR INDEX	INDEX-1
PERSONAL AUTHOR INDEX	INDEX-8
SUBJECT INDEX	INDEX-40
REPORT NUMBER INDEX	INDEX-98

Chemistry
QC
770
.U56

Volume 16, Number 16 August 31, 1962

NUCLEAR SCIENCE ABSTRACTS

GENERAL AND MISCELLANEOUS

20041 (BMI-1574(Del.)) PROGRESS RELATING TO CIVILIAN APPLICATIONS DURING MARCH 1962. Russell W. Dayton and Ronald F. Dickerson (Battelle Memorial Inst., Columbus, Ohio). Apr. 1, 1962. Contract W-7405-Eng-92. 87p.

Research and development progress is reported on reactor materials and components, fuels, fuel-elements, preparation of UO_2 single crystals, radioisotope and radiation applications, materials evaluation, coated-particle fuel materials, corrosion studies of Fluoride-Volatility Process, USAEC-AECL cooperative program, radiation effects on candidate fuel materials for MGCR, materials for SM reactors, gas-cooled reactor program, and gas-pressure bonding of beryllium-clad elements. (M.C.G.)

20042 (BNL-696) NUCLEAR ENGINEERING DEPARTMENT PROGRESS REPORT, MAY 1–AUGUST 31, 1961. Jean H. Reynolds, ed. (Brookhaven National Lab., Upton, N. Y.). Contract [AT(30-2)-GEN-16]. 66p.

Reactor Theory. Reactor physics studies of settled bed fuel reactors were obtained over the full density range of Na for the several reactor types under consideration. Design studies of reactor safety of the HFBR under meltdown conditions were completed. Studies of fuel storage configurations are continuing. Studies of high conversion ratio, Pu-fueled reactors are continuing. It is found that specific powers of up to 2 Mw (thermal)/kg Pu are obtainable with D_2O cooled rod clusters of low Pu content. The investigation of the radiation field in a polymerization vessel was completed. The systematic comparison of theory and experiment was extended to integral measurements of resonance capture in U–H_2O lattices, to U^{238}/U^{235} fission ratios measured in Snell experiments, and in single rods in graphite. Theoretical calculations of the thermal diffusion length and diffusion cooling coefficient in water and disadvantage factors in water moderated slab lattices were compared with recent BNL experimental data. The detailed comparison of the anisotropic neutron spectrum in the Campbell-Poole lattice was completed. Calculations of criticality in Be moderated experimental assemblies are continuing. More general work reported includes calculations of resonance capture in D_2O as well as H_2O cooled lattices, transport theory calculations of thermal diffusion anisotropy in slab lattices, fission product poisoning in fast reactors, Xe instability, neutron thermalization, and temperature coefficients of heterogeneous reactors. Experimental Reactor Physics. During this quarter work continued on the slightly enriched U and uranium oxide, light water moderated lattices. Additional pulsed-neutron and HFBR experiments were carried out. Measurements were performed on the 1.3% enriched slab lattice with a volume ratio of 1.5:1, the 3% enriched 1.5:1 uranium oxide lattice with poison, miniature slab lattices of all volume ratios, and miniature oxide lattices of various volume ratios. An indirect technique for the measurement of epicadmium to subcadmium capture ratios in U^{238} was developed. Measurements of epicadmium-to-subcadmium fission ratios in U^{235} in the 1% enriched 0.387-in. dia. U rod lattices were performed for all volume ratios. Measurements of the neutron diffusion properties of water-boric acid systems were performed. Measurements of the diffusion properties of graphite, Bi, and graphite-Bi mixtures were carried out with much-improved pulsed-neutron techniques. Excess reactivity measurements on the final design of the HFBR were completed, as were measurements of control rod and water level worths. A compact device, the RHOETTE, was developed and tested for the measurement of reactivities. The construction phase of the Minimum Reflection Criticality Facility is almost complete. Chemistry. Studies are continuing on the mechanism of solid state polymerization, in the kinetics of radiation induced polymerization, and on the mechanism of the radiolysis of aromatic compounds. The free energy of formation of $CeCl_3$ was obtained from emf measurements on cells in which both the electrodes and the electrolytes were solids. The value at 500°C is −206.5 kcal. A new type of cell which should be very useful for measuring the thermodynamic properties of salt mixtures was designed and successfully tested. Chemical Technology. The coefficients of expansion of ThO_2 were evaluated up to 1500°C. Equipment permitting measurements up to 2500°C is under development. The adsorption isotherm at 300°C of I_2 on a second sample, "B," of type R-4 graphite was determined by means of a tracer technique utilizing a sodium iodide scintillation probe. The major effort over the past few months was centered on the assembling of a small engineering scale plant for producing phosphate glasses from simulated Purex waste. The purpose of the plant is to test materials of construction for the high temperature crucible and to study operational problems and glass handling techniques on a more realistic scale. Data are presented on the radiation polymerization of ethylene, on the radiation formation of UC, hydrazine, and hydroxylamine, on metal decomposition, and on the decomposition of LiH. The recovery of U from Zr-based fuels was improved by carrying out the hydrochlorination and fluorination reactions at lower temperatures. A packed bed filter was used successfully for off-gas filtration. In the chlorination of SS the effect of caking about the metal coupon during the reaction was investigated. Several experiments were carried out in which NOCl was used

as a chlorinating agent for SS. Small-scale studies were continued on the development of the Nitrofluor Process for recovering U and Pu from reactor fuel. This nonaqueous method is based on fuel dissolution in NO_2–HF solution and final recovery of the U and Pu as their volatile hexafluorides. Additional factors affecting the conversion of $NOUF_6$ to UF_6 by treatment with Br_3 were investigated. Contamination of the NO_2–HF dissolver solution with BrF_3, and an equilibrium between $NOUF_6$ and its reaction products with BrF_3, appear to limit the conversion. The addition of BrF_5 to BrF_3 and use of higher temperature (200°C) gave good conversion of $NOUF_6$ to UF_6. Graphite-UC fuel was disintegrated in NO_2–HF solution at 93°C by increasing the contact time to 17 hr. Stress corrosion cracking of Monel in the vapor phase of NO_2–HF solutions was experienced, but attempts to cause failure in test specimens were unsuccessful even in the presence of free oxygen. The corrosion of Monel specimens in NO_2–HF solutions containing added water was investigated further in 18-hr tests at room temperature. In general, vapor phase corrosion was greater than liquid phase corrosion for solutions containing no more than 4.1 wt % H_2O. Strained corrosion specimens showed no worse corrosion than the rest. Aluminum oxide materials were found to be of little use in NO_2–HF solutions at 150°C. Monel specimens exposed to NO_2–HF solution for 5.7 days at 108°C showed little attack; however, the vapor phase portion of the Monel container vessel was attacked, especially at the top. The corrosion of Monel during distillation of NO_2–HF solutions was also investigated. The condenser was seriously pitted and corroded; the column showed no sign of attack and the still pot showed only slight corrosion. The electrical conductivity of dilute solutions of NO_2 in HF was measured and an ionization scheme was postulated. The infrared spectrum of NO_2–HF solution indicated the presence of NO_2^+ ion rather than the $H_2NO_3^+$ ion previously postulated. Solutions of NO_2 and HF are believed to contain $NOF \cdot 3HF$ and either HNO_3, or a compound formed from HNO_3 and HF. The reactivity with Zr of HNO_3–HF mixtures was investigated in a prepared solution and it was found to be much less than that of $NOF \cdot 3HF$. This latter compound may have promise as an alternate solvent in view of its apparent lower corrosiveness. An analytical train was assembled for determining the HF and O contents of NO_2–HF systems. Good precision was obtained for HF adsorption on NaF; however, NO_2 was also adsorbed slightly by this material. The fractional uptake of Te by Al foil was determined using radioactive tracer. The percentage release of I, Ba, and La from irradiated U samples melted at 1125°C for 30 min in an atmosphere of He was measured. The expected vapor composition was calculated from equilibrium thermodynamic considerations for a typical meltdown experiment. Engineering. In work on liquid metal-fused salt extraction columns, experiments on axial mixing in the continuous salt phase of a 4-in. ID disk-and-doughnut column were carried out. Peclet numbers estimated from the data appear to increase with salt flow rate. No effect of metal flow rate is apparent. In the liquid-metal heat transfer work, considerable experimental data were obtained for the case of turbulent flow of Hg through unbaffled rod bundles. These data were obtained on three different wetted test heaters in a 13-rod bundle. The results for the three heaters were in excellent agreement, showed no significant circumferential variation, and showed good agreement with theory at the higher Peclet numbers but poorer agreement at the lower Peclet numbers. A loop for similar work with alkali metals was under construction for several months and will be ready for operation in the late fall. The process design of a loop for studying heat transfer rates and pressure drop for the case of boiling K flowing through a vertical tube was completed. It calls for boiling temperatures of up to 1850°F and heat fluxes of up to 500,000 Btu/hr-ft^2. Hot Laboratory. Tentative values of 22.5 ± 2.8 mb and 1.96 ± 0.17 b were measured for the respective cross sections of $Ti^{50}(n,\alpha)Ca^{47}$ and $Ca^{48}(n,2n)Ca^{47}$ reactions. The use of H_2O_2 in the chemical isolation of I^{124} is apparently required if that isotope is to iodinate protein. A search is under way for the $Te^{130}(t,p)Te^{132}$ reaction. Attempts are being made to characterize several short-lived Sn isotopes formed in fission, particularly Sn^{129}. Additional evidence has been found in the decay of Sc^{48} for the existence of a weak gamma, the energy of which has been found to be 0.176 Mev; it is unlikely that a second β^- (if any) exists in a significant amount (>10% of the disintegrations). Possible methods of supplying a pure x ray emitter (Cs^{131}) and of increasing its effective half-life for shipping purposes by a factor of 4 are being investigated. Calculations show Sm^{151} would not make a suitable radiography source unless made by neutron fluxes much higher than those readily available at present. The flux of tritons in a neutron-irradiated Li^6-containing medium as a function of triton energy was derived rigorously. The enhanced extraction of Th by thenoyltrifluoroacetone (HT) in the presence of tri-n-octylamine (R_3N) was shown to be due to the formation of $R_3NHClHT$ and/or R_3NHCl but not due to R_3NHT. Chemical concentration of Mn from blood plasma, followed by arcing small samples at high currents, now permits detection of 3×10^{-10} g Mn via emission spectrography. Conditions were found for determining dilute Cd and Zn dissolved in LiCl–KCl via controlled-potential coulometry; the standard potentials of Rh^{3+}/Rh and Ir^{3+}/Ir couples in the same eutectic were measured relative to the Pt^{2+}/Pt reference electrode. Pb can be studied quantitatively at the dropping electrode in $LiNO_3$–KNO_3 eutectic; previous difficulties with controlled-potential coulometry in this medium were traced definitely to oxidation of insufficiently noble metal amalgams by the nitrate melt. Potentiometric studies in $NaNO_3$–KNO_3 eutectic indicate that Cu^{2+} is too acidic to form stable solutions in this melt. The oxidation-reduction potentials of 13 elements in molten bromide and molten iodide systems were measured. Zr was found to have excellent adsorption characteristics for Te and Mo from HNO_3 solutions, and Te in ≤2 N HNO_3 is adsorbed much more strongly than on chromatographic alumina. X ray spectrometric studies were made on U^{233}, U^{235}, and U^{238}. A rapid method of separating small amounts of Hf from large amounts of Ta utilizes methyl isobutyl ketone extraction of a tantalum fluoride complex. In the area of isotope production, the first shipment of Mo^{99} per se, the largest shipment (38.4 mC) of F^{18}, and shipments of Ar^{39} were made to Australia, Switzerland, and France, and a shipment of Mg^{28} was made to France. "D" waste inventory reached a low of 36,555 gal, but a contamination incident combined with switching to one-shift operation of the Waste Concentration Plant increased the inventory to ≈100,000 gal as of the end of this period. Metallurgy. Three all-liquid and nine boiling Hg loops were operated. The longest operation time of each type was ≈1 year. Gross corrosion or deposition was not observed by radiography; slight corrosion in the condensing area and slight deposition at the liquid-vapor interface were observed. Refractory metal loops were fabricated. Radioactive Ag is being used to study migration of dissolved atoms through the Hg and their carryover into the vapor phase region. High velocity boiling loops are being tested. Reflux-type boiling Na capsules to test corrosion resistance of materials to this fluid at 2200°F were constructed and are being tested. The first Nb–1 Zr thermal convection

loop test for high temperature Na corrosion studies is ready to be started. Boiling Na loops are being fabricated. Methods of producing alloys of controlled C content from high purity Fe are being studied. Release of fission product Xe^{133} from UBi_2 dispersions in Bi at 600 to 700°C probably is by diffusion in the [001] crystallographic direction in the UBi_2 particles. Diffusion in this temperature range, and initially at 800°C, obeys the relationship, $D = 1.43 \times 10^{-2}$ exp (−22970/T); long-term behavior at 800°C is more complex. During electrolysis of liquid Fe−Bi alloys, Fe tends to migrate against the electron flow. Intensity measurements of Zr activity from autoradiographs of uniform ZrN and ZrC films on steels indicate quantitatively the amount of Zr present in the films. Liquidus curves of the systems V−Bi, Nb−Bi, and Os−Bi were investigated. Os was found to be insoluble at temperatures up to 800°C. The density isotherm of the Cu-liquid Pb system was measured at 632°C. Calculations of the dissociation energies of the H_2^+ and H_2 molecules by the cell integration method are very encouraging. Examination of the in-pile section of the Radiation Loop was completed. No evidence of corrosion pitting, change in steel sample microstructure, decarburization, or deposition was found. Varying degrees of liquid penetration into the graphite specimens were observed, ranging from heavy penetration to no penetration. Graphite G and EY-9 were found to be impermeable to Bi. A meltdown of a BNL fuel element was shown to result from locally high U content of the fuel alloy. Irradiation effects measurements on as-received pure Fe have shown that irradiation increases in the yield stress are greater in coarse-grained material, and the work-hardening coefficient after irradiation is independent of the grain size. Vacuum-remelted Fe samples show a ductile-brittle transition 100°K higher than the as-received Fe. The stored energy release from graphite that was annealed many times before receiving its final irradiation is more sluggish than from fresh, irradiated (not previously annealed) specimens. Stored energy releases were observed below 200°C, between 200 and 370°C, and between 370 and 600°C. After a 350°C anneal in the pile, no subsequent stored energy was released upon subsequent laboratory annealing of the sample up to 650°C. Recovery of the thermal conductivity of irradiated graphite is not significant at annealing temperatures below 600°C. Appreciable recovery is obtained only at 1000 to 1400°C; even at this maximum temperature, recovery is only half complete. Temperature rises in insulated, 12-ft long mockup Graphite Research Reactor channels were measured during air flow at 650 to 800°C in open and partially-blocked channels. With one end open, maximum temperature rises were measured to be <10°C/hr at 650°C, 15°C/hr at 700°C, 50°C/15 min at 750°C, and 40°C/10 min at 800°C. A maximum of 3 ft of the channel (near the open end) increased in temperature at 800°C; the heating zone was progressively smaller at lower temperatures. With both ends open, the graphite at the ends cooled, while adjacent sections of the channel increased in temperature. Rapid rises occurred at temperatures above 700°C. Neither partial plugging nor partial air flow can be relied upon to cool a channel initially above 700°C in the absence of other heat losses; at 700°C an appreciable fraction of the total available Graphite Research Reactor air flow is required to cool rapidly. Experimental measurement of the electrical properties of irradiated graphite has been initiated; they will be measured over a temperature range of −196 to +350°C. The use of Ta crucibles greatly improved the reproducibility of measurements of Xe release from irradiated UC powders. Surface deposits on Nb−1 Zr tubing heat-treated 1000 hr at 2200°F in vacuo were identified as NbC or a solid solution of NbC and NbN. A brittle failure was found in a liquid-gas carbon steel waste line from the cosmotron. Stress concentrations adjacent to a weld apparently increased the probability of brittle failure of carbon steel at low (−423°F) temperatures. Mechanical Engineering. The High Flux Beam Reactor preliminary Hazards Summary Report was submitted to the AEC and approval to proceed with construction was granted. The general arrangement and most of the detailed drawings were completed at least for 70% approval. The over-all detail design is about 60% complete. The project staff continues to review drawings, specifications, inquiry packages, and bid tabulations and forward comments to the AEC. Bids are now being received on certain major equipment. The contractor is preparing an inquiry package to go out for bids on general concrete and building construction. A reactivity oscillator for the HFBR Critical Assembly has been designed, constructed, and installed. Motorizing of the fuel handling positioning carriage was completed and will be installed in the HFBR Fuel Handling Mockup. Erection of the HFBR Flow Reversal Test Loop has been completed and the loop is in operation. Evaluations were completed for a PWR hydraulic control rod drive. A seal assembly for the rotary calciner seal development project was designed. Preliminary design of major components for the chemonuclear loop was completed. The design of the in-pile section and a mockup of the in-pile section are in process. Design of the fuel element test apparatus was completed. Construction continues on the canal gate, lead shielding doors, and turntable for the High Intensity Radiation Development Laboratory. Specifications for the conveyor system are complete and were sent out for bids. The High Intensity Radiation Development Laboratory Building is about 50% complete. The Mark I research irradiator was installed at MIT. Serial #1 of the Mark II irradiators was installed in the University of California at Davis. Serial #2 unit was assembled and tested and is awaiting shipment to the University of Washington in Seattle. The Co^{60} sources for all three irradiators are undergoing double encapsulation. Construction of the NaK Heat Transfer Loop is nearing completion. The loop was leak tested and found tight. Almost all design work has been completed. All components for the Laminar Fluidized Bed Loop were completed. The Boiling Mercury Loop is being revised because of higher operating pressures and temperatures than originally anticipated. All materials required for fabrication of piping and equipment for the Forced Circulation Boiling Na Loop were received. Design of loop components is in progress. The High Temperature Furnace for graphite oxidation studies has been designed. The shielding design will begin shortly. The Low Mass Critical Assembly has been completed and various components are being tested. Fabrication of the Slow Neutron Chopper was completed. The table and sustaining equipment are being designed. A shielding containment for the Miniature Rod Lattice Experiments was designed, fabricated, and installed. Steel fuel trays were fabricated to replace wooden trays being used in the Graphite Research Reactor vault. (auth)

20043 (NP-11537) RESEARCH IN PROGRESS DURING CALENDAR YEAR 1961 UNDER THE AUSPICES OF THE U. S. ARMY RESEARCH OFFICE (DURHAM). (Army Research Office, Durham, N. C.). 266p.

Research progress in physics, chemistry, mathematics, engineering, and metallurgy and ceramics is given. Reasons for army interest are outlined. (M.C.G.)

20044 (NP-11606) AUSTRALIAN ATOMIC ENERGY COMMISSION, NINTH ANNUAL REPORT, 1960−1961.

(Australia. Atomic Energy Commission). June 30, 1961. 84p.

Progress is reported on the development of the uranium industry in Australia, the search for uranium, uranium mining, raw materials, research, nuclear power, and general developments. (M.C.G.)

20045 (NP-11611) EUROPEAN ATOMIC ENERGY COMMUNITY FOURTH GENERAL REPORT ON THE ACTIVITIES OF THE COMMUNITY (APRIL 1960–MARCH 1961). (European Atomic Energy Community). May 18, 1961. 166p.

Activities of EURATOM are reported. Topics covered include research, European universities and schools, dissemination of information, industry and economy, supply, health and safety, safeguards and controls, external relations, institutions of the Community, administration, and finances. (M.C.G.)

20046 (PNE-116F) DESIGN, TESTING, AND FIELD PUMPING OF GROUT MIXTURES. Final Report. James M. Polatty and Ralph A. Bendinelli (Waterways Experiment Station, Vicksburg, Miss.). Mar. 1962. Project GNOME. 27p.

The U. S. Army Engineer Waterways Experiment Station furnished drilling consultant services and performed core testing and grouting operations in connection with Project GNOME. The latter included performing physical tests and petrographic examinations on salt cores from the project site; designing grout mixtures, to match physical properties of the salt, for use in grouting instruments in place and in connection with installing underground structural appurtenances; and drilling and grouting at the site to embed scientific instruments and in connection with structural work within the tunnel. (auth)

20047 (PNE-127F) PRE-SHOT AND POSTSHOT STRUCTURE SURVEY. Final Report. (Holmes and Narver, Inc., Los Angeles). Apr. 1962. Contract AT(29-2)-20. 111p. Project GNOME.

A survey was made to record the pre-event and post-event conditions of all surface facilities in a 10-mile radius of ground zero for project GNOME. Damage was very slight and it was concluded that future projects of a similar nature can be pursued with minimum danger to comparable surface structures at similar ranges. (J.R.D.)

20048 (PNE-134F) PRE- AND POST-SHOT MINE SURVEY. Summary Report. Paul L. Russell (Bureau of Mines, Washington, D. C.). Apr. 1962. Project GNOME. 30p.

A program to assess damage from Project GNOME, if such should occur, was initiated about 90 days prior to the nuclear test and continued for about two weeks following the test. Mines, shafts, and surface plants of all seven of the potash companies in the area were included in the survey. Methods employed in the assessment program included: visual and photographic inspection; surface profile surveys; underground profile surveys; underground and surface seismic recordings; radiation surveys; microseismic surveys; and water level surveys. No visible or apparent damage was evidenced in the mines. (auth)

20049 (SC-4596(RR)) 20-TON He CRATERING EXPERIMENTS IN DESERT ALLUVIUM. FINAL REPORT, MAY 1962. R. H. Bishop, R. J. Burton, A. J. Chabai, D. M. Hankins, V. A. Harris, J. R. Heaston, H. R. MacDougall, B. F. Murphey, J. W. Reed, and L. J. Vortman—G. R. Miller, ed. (Sandia Corp., Albuquerque, N. Mex.). Mar. 1960. Project STAGECOACH. Contract [AT(29-1)-789]. 300p.

Project Stagecoach consisted of the detonation of three 40,000-pound charges. Blocks of cast TNT were stacked to resemble a sphere and, the whole center-detonated. The Stagecoach experiment confirmed that cube-root scaling is not valid for all burst depths in desert alluvium. The first strong indication of a fourth-root scaling law for crater explosions was obtained from the Stagecoach program. Scaling changes from cube-root scaling for surface bursts and for small charges at other depths, to fourth-root scaling for large-yield, deeply buried shots according to whether the contribution of the atmospheric pressure to the overburden is all or a small percentage of the total overburden pressure. Ground surface motion was obtained from motion picture photography. Early velocity of the surface at ground zero decreased roughly in proportion to the square of the burial depth. Peak accelerations of the ground surface decreased with depth of burst about as the fourth power of the burst depth. Pressures existing at very long times after the initial shock imparted upward momentum to the earth result in continued upward motion of the mound. Continued motion must be caused both by the expanding gas bubble and by the momentum of the material above the charge. From simple experiments, reliable data were obtained on distribution and quantity of fine particulate ejected by the Stagecoach explosions. An empirical relationship was obtained which allows the total mass of particulate deposited to be estimated within an order of magnitude from crater volumes alone. Twenty-eight pellets tagged with Sb^{124} were buried about the explosive charge in the region which ultimately became the crater void. Their initial positions were recorded as to depth and distance from the epicenter. The preshot position, together with postshot positions of the pellets, yielded information which permitted estimates of approximate trajectories of crater ejecta and an estimate of the effective initial velocity field of earth particles in the crater void region. Reliable data were obtained on areal density of earth material deposited ballistically from the crater's edge radially outward and on the total mass of earth ejected by the explosion. A fairly large volume of earth in the region adjacent to the crater wall was not ejected beyond the crater's edge but was retained within the crater. The deeper Stagecoach explosion deposited more earth close to the crater edge and considerably less at distances farther from the edge than did the shallower shot. Stagecoach vertical displacements of the dust cloud, including earth mound, smoke crown, column, and jetting material, were determined from motion picture photography. Horizontal dimensions of the base surge, column, smoke crown, and jet were also determined. Vertical velocities as a function of time for the mound, column, smoke crown, and jet were obtained. Vertical displacement- and vertical velocity-time curves for the two shallower shots had comparable shapes. That for the deepest shot, however, was quite different from the two shallower shots. Where gravity effects were ignored, cloud dimensions and times were proportional to the cube root of the charge weight during explosion-produced motions which end when the jets reach apogee. Until that time, moderate winds had relatively little influence. Subsequently, the phenomena were essentially independent of the explosion and depended more and more upon local meteorological conditions. No jets developed on the deep Stagecoach shot except those which resulted from the collapse of the mound into the cavity below. These jets resulted from compression of gases in the cavity by the downward plunge of the mound. Maximum height of the jet agreed reasonably well with expressions developed earlier for smaller charges in alluvium and other media. Column height and column width were quite distinct at early times, but maximum column

height and width were not uniquely identifiable features, since the column margins fade as the ejecta of the jet breaks through the column. Throwout concentration at a scaled distance of 20 ft/lb$^{\frac{1}{3}}$ increased by a factor of 2 over a range of charge weights from 8 to 40,000 pounds for a scaled burst depth of 0.5 ft/lb$^{\frac{1}{3}}$. For a scaled burst depth of 1.0 ft/lb$^{\frac{1}{3}}$, the factor at the same distance was 2.6. Initial velocities of rock missiles weighing approximately 8 pounds were approximately 1000 feet per second. These missiles occurred on the shot at 1.0 ft/lb$^{\frac{1}{3}}$. No significant number of rock missiles was found on either of the other Stagecoach shots. Suppression of close-in air blast with charge burial was defined for peak overpressure, positive-phase impulse, and positive-phase duration. The two shallower shots evidenced two separate shock waves. The first was a ground shock-induced air shock and the second was a shock wave resulting from gas venting. The main shock wave from the venting gas disappeared at some depth between the Stagecoach shots at 1 and 2.3 ft/lb$^{\frac{1}{3}}$. There was observational evidence of two separate and distinct ground-shock-induced waves on the deepest Stagecoach shot. One was a ground-shock-induced wave which appeared directly over the charge and which propagated through the air at sonic velocities. The second wave was generated by direct radial propagation of the earth shock and traveled across the ground surface at near ground-shock velocity. Seismic signals were recorded at an epicentral distance of about 170 kilometers. It was concluded that an increase in scaled depth from 0.5 to 2.3 ft/lb$^{\frac{1}{3}}$ increases seismic energy received at that distance, but the amount of increase with burst depth could not be defined. Postshot excavation of Stagecoach craters revealed that they were not cylindrically symmetrical. This lack of symmetry occurred in the true craters as well as in the apparent craters. The amount of these asymmetries apparently increased with scaled burst depth. In the region where the mound or base of the column joins the ground surface, there was evidence of compressive failure and overthrusting of the surface layers. Observations indicated that there was no appreciable permanent vertical displacement of the ground surface beyond 1.75 crater radii. On the deep Stagecoach shot the mound rose and fell into the cavity created by the explosion. Horizontal shift of the epicenter between preshot and postshot was only about 1 foot. Information is furnished on the engineering and design of the experiment, including site location and preparation, costs, excavation and casing of chambers to receive charges, and security and safety precautions. A preliminary test shot of 5000 pounds was fired to verify single-point detonation of large amounts of TNT. Information on the signal and communications systems is also included. (auth)

20050 PATENT RIGHTS AND THE DEVELOPMENT OF NUCLEAR ENERGY. W. Finke. Kerntechnik, 4: 60-6 (Feb. 1962). (In German)

The historical development of patent rights is sketched, and the modifications with respect to the field of nuclear energy in the United States, Great Britain, France, and the German Republic are indicated. These modifications are interpreted as representative of the relationship between the state and technology on the one hand and between public interest and individual rights on the other hand. The counter tendencies which have become clear lately during the normalization of the development of nuclear energy are also pointed out. (auth)

20051 TACTICAL NUCLEAR WEAPONS. Leonard Beaton. New Scientist, 14: 392-3(May 24, 1962).

The tactical use of nuclear weapons is discussed. The bombers and rockets used for delivery of the warhead and the effects of various yields are described. (M.C.G.)

20052 NUCLEAR ACCIDENTS AND LEGAL REMEDIES. F. L. Coombs. Nuclear Energy, 246-50(June 1962).

The legal remedies now available to a citizen of England in the event of a nuclear accident occurring within the jurisdiction are outlined. Damage resulting from nuclear operations are also considered. The Tort of Nuisance, Onus on the plaintiff, responsibility for damage, liability on operator, effect of secrecy, unknown source, the position abroad, and international agreement are discussed. (M.C.G.)

BIOLOGY AND MEDICINE

General and Miscellaneous

20053 STUDY OF THE CIRCULATION TIME OF PERIPHERAL BLOOD BY MEANS OF I^{131}-LABELED HUMAN SERUM ALBUMIN. I. BLOOD CIRCULATION IN THE FEET. Y. Cuypers and G. Merchie (Université, Liège). Acta Cardiol., 17: 117-32(1962). (In French)

By means of injection of albumin-I^{131} in the antecubital vein followed by scintillometric measurements over the foot, it was found possible to assess the peripheral circulation. Patients with obliterative arterial disease showed normal radioactivity curves at rest, but during excercise the relative blood flow and velocity of circulation were much lower than in healthy control subjects. The optimal dose of albumin-I^{131} was 40 mc and was injected in a volume of 0.5-1.0 ml saline in a period of 1-2 sec, and measurements were made for 7 min thereafter. (H.H.D.)

20054 THEORY AND APPLICATION OF AUTORADIOGRAPHY. Jurgen R. Meyer-Arendt (Utah State Univ., Logan). Acta Histochem., 13: 47-61(Mar. 1861). (In English)

The use of radioisotopes in histologic studies is discussed, with particular emphasis on the nuclear reactions involved and the type of radiation emitted by various isotopes. Experimental applications and advantages, type of emission, and half-life times are given for H^3, C^{14}, Na^{24}, P^{32}, S^{35}, Ca^{45}, Cr^{51}, Fe^{59}, Co^{60}, Zn^{65}, As^{74}, Sr^{89}, Y^{90}, I^{131}, Ta^{182}, Ir^{192}, Au^{198}, Tl^{204}, Ra^{226}, Th^{232}, and U^{238}. Autoradiographic methods are considered including those involving apposition, liquid emulsion, stripping-film, and inversion techniques. Ways for evaluating grain patterns and single tracks for α and β particles and γ rays are also discussed. (H.H.D.)

20055 CR-51 TAGGED RED CELL STUDIES. I. THE RED CELL MASS IN FILIPINOS. Augusto D. Litonjua, Paulo C. Campos, Gerardo de Leon, and Benjamin Baltasar. Acta Med. Philippina, 14: 221-33(Apr.–June 1958).

The red cell volume was determined in normal Filipinos by means of an autotransfusion technique using $Na_2Cr^{51}O_4$ as a tracer. The red cell volume was shown to be positively correlated with body weight and body surface. (C.H.)

20056 CR-51 TAGGED RED CELL STUDIES. II. THE APPARENT HALF-SURVIVAL TIME OF ERYTHROCYTES. Augusto D. Litonjua, Paulo C. Campos, and Benjamin Baltasar. Acta Med. Philippina, 14: 235-49(Apr.–June 1958).

The mean apparent half-survival time of erythrocytes in normal Filipinos was established as 33 days. Cr^{51} labeled red cells were used as tracers in the study. (C.H.)

20057 RADIATION RESPONSE IN PATIENTS WITH CERVICAL CANCER. Seppo Kangas (Univ. of Turku, Finland). Acta Pathol. Microbiol. Scand., Suppl., 154: 179-80 (1962). (In English)

The effect of ionizing radiation on the morphology of vaginal squamous epithelial cells was studied in 136 cases of cervical carcinoma. The cells in vaginal smears were examined for size, vacuolation of cytoplasm, and number of nuclei; radiation response was considered good if such changes were found in 70% or more of the cells. In patients below the age of 45, 16% fewer good radiation responses were found than in patients over 45 years of age. Responses were more often good (48%) in patients with grade I carcinomas than in those with more malignant tumors. Follow-up studies 1.5 to 5 years after irradiation showed a lower mortality rate (14%) for patients with good radiation responses than those with poor responses (26%). None of the patients with grades I and II carcinomas died after good cytological reactions, whereas 15% of those with poor reactions died. Although some correlation was found between cytological radiation response and prognosis, a good response did not invariably accompany elimination of cancer. (H.H.D.)

20058 LOCALIZATION OF GASTROINTESTINAL HEMORRHAGE WITH RADIOIODINE. Henry Brown, John Cameron, Toyomi Fujino, Erwin R. Schmidt, and Julie Brown. Am. J. Surgery, 103: 370-1(Mar. 1962).

The technique is carried out by intravenous injection of I^{131}-labeled serum albumin or Hippuran followed by introduction of a probe-type scintillation counter directly into the abdominal cavity during laparotomy. Counts over the bleeding point were generally more than double that of the background. Counting was more efficient without shielding the probe since the larger the number of counts the more significant the difference between background and total radiation. The method was more effective when the bowel was scanned after removal from the abdominal cavity than in situ scanning. In a cited example of massive duodenal hemorrhage, the affected segment of intestine showed a 6240 cpm compared with 1920–2400 in adjacent segments. (H.H.D.)

20059 RADIOACTIVE MEASUREMENTS IN THE LIVING FISH. Maria Elena Facugauchi. Arkiv Kemi, 15: 375-7(1960). (In English)

The radioactivity of Hyphessobrycon scholzei was determined after feeding the fish exclusively with dry blood containing Fe^{59}. In the course of 126 days a fish weighing 100 mg took up 2 μg of iron. 1/330 part of the iron fed was taken up by the fish. The rest and thus presumably all of it taken in was fully excreted in the course of 16 to 24 hours. (auth)

20060 INVESTIGATIONS ON THE DECORPORATION OF RADIOSTRONTIUM. A. Catsch (Kernforschungszentrum, Karlsruhe, Ger.). Atomkernenergie, 7: 65-70(Feb. 1962). (In German)

The influence of the strontium-disodium chelate of 2 : 2′-bis[di(carboxymethyl)amino]diethylether on the skeletal deposition of intraperitoneally or subcutaneously administered radiostrontium in rats was studied. A relatively high reduction of radiostrontium deposition was observed with early administration only. The compound was superior to zirconium citrate and its effectiveness was independent of the mode of administration (single or fractionated dose or drop infusion). The chelate was shown to be ineffective in the case of a peroral administration of radiostrontium. A reduced effectiveness was also observed in removal of colloidal radiostrontium. The toxicity range and the dependence of the effectiveness on dose were determined. The implications of the experimental findings for the clinical use of the compound are discussed. (auth)

20061 INHIBITION OF VARIOUS MAMMALIAN AMYLASES BY BERYLLIUM AND ALUMINUM. Robert L. McGeachin, Wanda M. Pavord, and William C. Pavord (Univ. of Louisville School of Medicine, Ky.). Biochem. Pharmacol., 11: 493-8(June 1962).

Beryllium and aluminum salts in concentrations from 10^{-2} to 10^{-5} M will inhibit amylases from man, hog, rat,

and dog to varying degrees. Magnesium, barium, and strontium salts do not inhibit these amylases. Certain proteins or salts of various carboxylic acids reduce the inhibiting effects of beryllium and aluminum. It is postulated that beryllium and aluminum produce these effects by complexing the free carboxyl groups of the amylases in such fashion that the structure of the original molecule is deformed and the enzyme activity is reduced. (auth)

20062 LEUKOCYTE KINETICS STUDIED BY NITROGEN MUSTARD INDUCED ALTERATIONS IN DNA PHOSPHORUS LABELING. Richard I. Walker, J. C. Herion, and J. G. Palmer (Univ. of North Carolina, Chapel Hill). Blood, 20: 72-82(July 1962).

The effect of a large dose of nitrogen mustard on total and differential leukocyte counts in rabbits was studied in conjunction with the effect on DNA labeling with inorganic radiophosphorus. Considered together, the findings indicate that this dose of nitrogen mustard has a direct lethal effect on lymphocytes and effectively blocks P^{32} incorporation into leukocyte DNA for several days by killing the elements capable of division. The post-mitotic granulocyte reservoir seems to remain intact and is of sufficient size to replace those lost from the circulation for about 56 hours. Granulocyte circulating half-time under the conditions of these experiments falls between two and seven hours. The post-mitotic granulocyte reservoir is calculated to be 40 times the size of the circulating pool. During the period of rapid granulocyte recovery, leukocytes have been shown to exhibit a decreasing concentration of DNA label per element and maintenance of the same level of label per element depending on the availability of precursor P^{32}. At present no conclusion about DNA labeling characteristics with inorganic P^{32} under steady state conditions is warranted. (auth)

20063 THE TOXIC EFFECT OF INTERMEDIATE OXIDATION PRODUCTS OF OLEIC ACID ON YEAST CELLS. G. I. Casanov and Yu. B. Kudryashov (Moscow Univ.). Doklady Akad. Nauk S.S.S.R., 143: 1453-4(Apr. 21, 1962). (In Russian)

Oxidized oleic acid has a harmful effect on cells that is similar to the effect of gamma irradiation. Haploid yeast cultures (Zygosaccharomices bailli) were treated with an emulsion of oleic acid. The most harmful effect on the yeast cells was observed on adding oleic acid which had been oxidized for 5 days, and also for 20 days. It was found that the harmful effect on the yeast cells was directly proportional to the increase of peroxide observed in the oxidized oleic acid. The concentration of epoxides could not be related to the number of dead yeast cells. The chemical effect of the peroxide, and not the change in acidity of the medium, was harmful to the yeast cells. (TTT)

20064 EFFECTS OF THYROXINE UPON STRONTIUM AND CALCIUM METABOLISM OF EMBRYONIC BONE GROWN IN VITRO. F. W. Lengemann (Cornell Univ., Ithaca, N. Y.). Endocrinology, 70: 774-80(June 1962).

Embryonic chick bone was cultured in a synthetic medium for periods up to 7 days to determine the effect of levels of 0.05 to 5.0 μg thyroxine per 100 ml medium upon the uptake and removal of Sr^{85} and Ca^{45} from bone. Thyroxine generally caused a decrease in the bone content of Sr^{85} and Ca^{45}, reduced growth and reduced selection against strontium. Serum in the medium seemed to eliminate the effect of thyroxine. The reduced content of Sr^{85} and Ca^{45} due to thyroxine was evident in bone cultured at 37°C but not at 30°C. The removal of radionuclides from labeled bones was decreased by the presence of thyroxine. The results are interpreted to mean that thyroxine could increase the conversion of labile bone Sr^{85} and Ca^{45} into the nonlabile fraction and reduce its reconversion back to the labile form. (auth)

20065 REGIONAL PULMONARY FUNCTION STUDIED WITH XENON^{133}. W. C. Ball, Jr., P. B. Stewart, L. G. S. Newsham, and D. V. Bates (McGill Univ., Montreal). J. Clin. Invest., 519-31(Mar. 1962).

A radioisotope of Xe was used in conjunction with externally placed scintillation counters to estimate separately the function of different regions of the lung. The gamma and x-ray emission was sufficiently low to permit protection and shielding of detection instruments with $\frac{1}{16}$-in. lead, and the total dose used was low (40 mrads in normal subjects and 120 mrads in pathological cases). By comparison of external counting rates after a single breath and after rebreathing an air-Xe^{133} mixture, it was possible to compute an index of relative ventilation that is independent of lung volume within the counting field. Measurements were made at two levels of inhalation in order to compare the distribution during normal quiet breathing with the distribution after a single full inhalation. By intravenous injection of Xe^{133} dissolved in water during breath holding, the relative perfusion of lung by blood in various regions would be evaluated. The Xe^{133} method has several advantages over the O^{15} technique, especially since the latter isotope has a half life of only 2 min requiring the close proximity of a particle generator to form O^{15}. (H.H.D.)

20066 EXPERIMENTS ON THE MATERNAL-FETAL BARRIER IN THE MOUSE. I. A TEST FOR THE TRANSMISSION OF MATERNAL ERYTHROCYTES ACROSS THE MOUSE PLACENTA FOLLOWING X IRRADIATION. Milton Feingold (Bellevue Hospital Center, New York) and Donald Michie. J. Embryol. Exptl. Morphol., 9: 618-22 (Dec. 1961).

Pregnant mice were irradiated with 184-1000 r and injected with Cr^{51}-labeled red cells. The radiation was delivered only to the abdomen, the rest of the body being shielded. Unexpectedly, almost all of the newborn mice showed weak radioactivity, up to 13 counts/sec, with an average of 3.5. However, no radioactivity could be detected in the blood of the fetuses or newborn, indicating that maternal erythrocytes do not cross the placental barrier under normal conditions or after irradiation. In only 2 of the 279 fetuses examined could evidence of placental leakage be detected, so that in the mouse the incidence of transplacental passage of maternal red cells is less than 1%, in contrast to ~50% in the human species. Irradiation apparently did not increase this leakage in the mouse. (H.H.D.)

20067 EXPERIMENTS ON THE MATERNAL-FETAL BARRIER IN THE MOUSE. II. A TEST FOR THE TRANSMISSION OF MATERNAL SERUM ALBUMIN INTO THE FETAL CIRCULATION FOLLOWING X IRRADIATION. D. P. Knobel and Donald Michie (Univ. of Edinburgh). J. Embryol. Exptl. Morphol., 9: 623-7(Dec. 1961).

Female rats on the 13th to 19th day of gestation were given 300 r whole-body radiation and injected intravenously with Evan's blue. No transmission of serum albumin, which binds the dye from maternal to fetal circulation, could be detected in either irradiated or control animals. The results indicate that mice resemble rats and dogs rather than monkeys and rabbits with respect to mother-to-fetus transmission of serum albumin. (H.H.D.)

20068 CORRELATION OF A BIPHASIC METABOLIC RESPONSE WITH A BIPHASIC RESPONSE IN RESISTANCE TO TUBERCULOSIS IN RABBITS. Marvin J. Allison, Peter Zappasodi, and Max B. Lurie (Univ. of Pennsylvania, Philadelphia). J. Exptl. Med., 115: 881-90(May 1962).

Peritoneal exudate mononuclear cells obtained from BCG-vaccinated rabbits showed higher utilization of succinate, glycerophosphate, β-hydroxybutyrate, and glycerol than cells from control animals. No differences in utilization of the following substrates were noted: lactate, glucose-6-phosphate, malate, isocitrate, α-ketoglutarate, and glutamic acid. A second, later stage of elevated metabolic activity was associated with heightened resistance to infection. When rabbits which had been irradiated with 400 r 2 years previously were vaccinated with BCG, they failed to respond as shown by their lack of resistance to infection and failure of their mononuclear cells to show the biphasic metabolic stimulation. The results demonstrate the close relation between the metabolic capabilities of reticuloendothelial cells and their resistance to tuberculosis. (H.H.D.)

20069 RADIOACTIVE CESIUM AS A FISH AND LAMPREY MARK. D. P. Scott: J. Fisheries Research Board Can., 19: 149-57(Jan. 1962).

Experiments to test radioactive cesium-137 as a fish and lamprey ammocoete mark are described. The biological half life (turnover) of cesium in speckled trout (Salvelinus fontinalis) was 47.20 days. A successful field trial was carried out, using Cs^{137} for marking ammocoetes for subsequent recapture in streams undergoing chemical treatment for lamprey control. Use of Cs^{137} should be confined to species not usually used by man, or such fish should be marked and studied where no fishing is done. (Publ. Health Eng. Abstr.).

20070 THERAPY OF MULTIPLE MYELOMA WITH RADIOYTTRIUM (Y^{90}). Joseph Greenberg, Arthur Sawitsky, Louis Weisfuse, Robert N. Levy, Kanti R. Rai, and H. C. Dudley (Long Island Jewish Hospital, New York). J. Lab. Clin. Med., 898-904(June 1962).

Radioyttrium (Y^{90}), with low carrier content and chelated with an excess of N'hydroxyethylenediamine triacetic acid (Ed-ol), when administered intravenously is deposited selectively in the skeleton. The energetic β-emission (maximum 2.2 Mev) irradiates the adjacent marrow, causing preferential destruction, or at least a marked reduction, in its potential to produce immature or bizarre forms of the cellular elements of the blood. The results of clinical trials in 11 patients with multiple myeloma who had largely become unresponsive to other modalities of therapy are reported. The radioactive isotope was administered intravenously as a simple dose of radioyttrium (0.06 to 0.30 mc. per kilogram) chelated with an excess of Ed-ol and containing 0.05 mg. Y^{89} per kilogram as carrier. A good clinical response was obtained to the initial course in 6 patients. Duration of remission was 2 to 17 months. Response consisted of relief of pain and an improvement in sense of well-being except for a spontaneous rise in hemoglobin and hematocrit in 2 patients. Toxicity was limited to transient pancytopenia. Subsequent courses were unsuccessful. However, with the use of Y^{90} as the initial agent or earlier in the course of the disease, remission may be more far reaching and retreatment may also prove more effective. (auth)

20071 STUDIES ON THE DEPOSITION AND REMOVAL OF RADIOACTIVE SOIL. I. J. Pflug, T. I. Hedrick, O. W. Kaufmann, R. A. Keppeler, and C. G. Pheil. J. Milk and Food Technol., 24: 390-6(Dec. 1961).

The rate of deposition and removal of a radioactive milk soil from several surfaces have been studied. The nature of the surface exhibited a small but measurable effect on the rate of deposition of a radioactive milk soil on the surfaces tested. However, the surfaces showed no significant effect on the rate of soil removal. The build-up that took place on all surfaces due to repeated soilings without washing was not a simple additive accumulation of residue but appeared to be a selective deposit of a residue slowly laid down over a period of time and difficult to remove. As the accumulated residue increased, a point was reached beyond which there was no significant difference among surfaces in the rate of soil build-up. Subsequent washing removed only part of the soil and even repeated washings had little effect unless special heavy duty cleaning was applied. (Publ. Health Eng. Abstr.).

20072 THE SYNTHESIS OF Co^{57} TETRAPHENYLPORPHINESULFONATE AND ITS USE IN THE SCINTILLATION SCANNING OF NEOPLASMS. PRELIMINARY PROGRESS NOTE. James Winkelman (National Heart Inst., Bethesda, Md.), John G. McAfee, Henry N. Wagner, Jr., and R. Gordon Long. J. Nuclear Med., 3: 249-53(May 1962).

Tumors in mice and rats were delineated by scintillation scanning after the injection of cobalt-57-labeled chelates of tetraphenylporphinesulfonate (TPPS). Procedures are described for the synthesis of the labeled TPPS. The initial effective half life of Co^{57} was 8 days followed by a slower component of 28 days. The physical characteristics of Co^{57} are reviewed and it is shown that it is well suited to scintillation scanning. It is concluded that the calculated radiation dose and toxic effects on humans are well within permissible limits, assuming that the tissue distribution in man is similar to that in mice. (C.H.)

20073 RADIOPHOSPHORUS IN THE DIFFERENTIAL DIAGNOSIS OF PIGMENTARY NEOPLASMS OF THE EYE. E. I. Voznyuk and O. V. Grusha (Pirogov Inst. of Medicine, Moscow). Med. Radiol., 7: No. 4, 35-40(Apr. 1962). (In Russian)

Radiophosphorus was used for the diagnosis of pigmentary formations of the eye in 38 patients. A negative radiological test was obtained in 24 patients. Dynamic clinical observations confirmed the absence of malignization of the pigmentary formation. In 15 patients the radiological test was positive. It is concluded that the technique may be useful for the detection of early forms of malignization of the nevus. (auth)

20074 URETHAN INDUCTION OF THYMIC LYMPHOMA IN C57bl MICE. Ruth G. Doell (Stanford Univ., Palo Alto, Calif.) and William H. Carnes. Nature, 194: 588-9(May 12, 1962).

Studies were made on the induction of thymic lymphoma in C57bl mice by urethan alone. Urethan was injected subcutaneously into mice less than 24 hr old at a dose of 1 mg/g body weight, and seven further injections at the same dose were given at weekly intervals. Tumors were found in 12 of the 13 surviving at ages between 12 and 27 weeks, and dissemination was found in 7 of the 12. The tumors were identical histologically with those induced by irradiation. The same weekly urethan dose was injected intraperitoneally into C57bl mice for a total of 4 treatments, beginning at 4 to 5 weeks of age; only one of 19 mice developed lymphoma at 10 months. No lymphoid tumors were found in 30 untreated mice up to 1 year old. (D.L.C.)

20075 THE QUESTION OF THE pH DEPENDENCE OF THE STRONTIUM SORPTION IN SOILS. Diedrich Schroeder, Heinrich Graf von Reichenbach, and Gerd Freiherr von dem Bussche (Universitat, Kiel, Ger.). Naturwissenschaften, 49: 137-8(1962). (In German)

Because of the large affinity of hydrogen ions for clay minerals used as ion exchangers, it is to be expected that strontium sorption increases with increasing pH values.

The origin of this phenomenon is investigated. A series of studies was made to determine the strontium sorption as a function of the pH value in solution with increasing and with constant metal ion concentrations. The results show that the effect of the pH value on the strontium sorption is dependent on the ion concentration in the soil solution and, with increasing ion concentration in increasing volume, on the type of associated cations. (J.S.R.)

20076 THE LOCALIZATION OF POSITRON SOURCES BY COINCIDENCE COUNTING. C. Doust and H. A. B. Simons (Royal Free Hospital School of Medicine, London). Phys. in Med. Biol., 6: 271-82(Oct. 1961).

The geometrical theory for the variation of the sensitivity of a pair of coincidence counters with the position of a point source of a positron emitting isotope has been considered. A discussion of the problem of correcting this theory for the variation of crystal surface efficiency with the position of the source is given. Experiments to determine the sensitivity distribution for a pair of scintillation counters are described, both for the case in which the source is situated in air and also for that when it is in a scattering material. These experiments show that, provided the pulse discriminators are set to a value just below the 0.51-Mev photo-peak, the presence of the scattering material does not appreciably alter the resolution of the apparatus, and that the sensitivity distribution obtained experimentally is in close agreement with a modification of the geometrical theory. (auth)

20077 FIRST AID AFTER INTERNAL RADIOSTRONTIUM CONTAMINATION USING ORAL BARIUM SULPHATE. Vladimír Volf (Inst. of Industrial Hygiene and Occupational Diseases, Prague). Phys. in Med. Biol., 6: 287-94(Oct. 1961).

Two cases are reported of slight internal contamination following accidental Sr^{90} nitrate inhalation, treated orally with barium sulfate (Skiabaryum Spofa) given within 10 and 30 min following the accident. The effectiveness of oral barium sulfate treatment was also studied in experiments on rats. This substance caused an insignificant shift of intratracheally injected strontium-90 from urine to feces, a significantly higher removal of intraperitoneally administered strontium-90 via the gut, and a significantly lower absorption and skeletal deposition of strontium-90 given orally. Barium sulfate is a useful substance for first aid in internal contamination with radiostrontium. (auth)

20078 A SIMPLE FACILITY FOR WHOLE-BODY IRRADIATION. J. R. Cunningham and D. J. Wright (Ontario Cancer Inst., Toronto). Radiology, 78: 941-9(June 1962).

A simple adaptation of an existing Co^{60} unit made possible whole-body irradiation with little disruption of normal treatment schedules. With the apparatus described, a whole-body treatment of 850 rads (mid line) can be achieved within one or two hours, dependent on patient size, by a method involving a scanning procedure. The resulting increase in depth dose and dependence on SSD have been determined. Isodose curves have been measured for three degrees of collimation and a dose distribution for an empirical phantom is presented to show the degree of homogeneity obtainable. (auth)

20079 RADIOCARBON IN PLANT PRODUCTS: GEOGRAPHY, SPECIES, AND TIME. V. N. Kerr, D. L. Williams, E. Hansbury, and F. N. Hayes (Los Alamos Scientific Lab., N. Mex.). Z. Physik, 167: 273-83(1962). (In English)

C^{14} measurements, on a global scale, were made on a large number of essential oils obtained from various plants. The measurements allow conclusions to be drawn on the mixing of some compartments of the atmosphere and, in addition, metabolic differences between various species of plants are demonstrated. The course of C^{14} fallout, as recorded by the various plants, is charted. (auth)

20080 OCHERKI PO RADIOBIOLOGII. (Aspects of Radiobiology). A. A. Gorodetskii, B. P. Kirichinskii, and N. F. Lipkan. Kiev, Publishing House of the Academy of Sciences, Ukrainian SSR, 1961. 223p.

The basic aspects of radiation effects on living organisms are described, and dosimetry and protection measures are analyzed. The book is designed for biologists, physicians, and biochemists. An extensive reference list is included. (R.V.J.)

Biochemistry, Nutrition, and Toxicology

Refer also to abstract 20331.

20081 UPTAKE OF STRONTIUM-85 IN NON-MALIGNANT VERTEBRAL LESIONS IN MAN. Goeran C. H. Bauer and Paolo Scoccianti (Univ. of Lund, Sweden). Acta Orthopaed. Scand., 31: 90-102(1961). (In English)

By means of external scintillation counting, it was possible to demonstrate abnormally high spinal uptake of intravenously injected Sr^{85} in various diseases of the vertebral column. A total dose of 50 μc carrier-free Sr^{85} was injected 7 to 14 days before recording spinal radioactivity with a collimated scintillation detector. An abnormal activity pattern was defined as a deviation from the normal pattern of twice the standard deviation of the normal mean value. Abnormal spinal patterns were detected in vertebral fractures, ankylosing spondylitis, tuberculous spondylitis, nonspecific discitis, and in a case with a lytic lesion of unknown origin. The value of 14 days was found more reliable than that at 7 days since by this time Sr^{85} levels in soft tissues had fallen to low values. In 1 case, erroneous results were obtained from spinal counting due to a kidney stone which produced high activity in the spinal region. (H.H.D.)

20082 RADIOACTIVE WASTES IN THE MARINE ENVIRONMENT. Robert M. Brown (Maryland State Dept. of Health, Baltimore) and Donald W. Pritchard. Am. J. Public Health, 51: 1647-61(Nov. 1961).

Problems concerning contamination of sea-food supplies by radioactive materials are discussed particularly from the viewpoint of responsibilities of public health agencies. It is estimated that marine food products presently contribute less than $\frac{1}{1000}$th of the total intake of radioisotopes by the average resident of the United States and about $\frac{1}{200}$th of that of populations of other countries with high dietary sea-food consumption. Contributions of various sources to marine radioactivity are discussed, including that from fall-out from weapons testing, nuclear fuel processing plants, packaged wastes, and discharges from nuclear-powered ships and land-based reactors. Other problems considered are: monitoring of marine radioactivity, transport of radioactivity by ocean currents, assimilation and retention of radioisotopes by marine life, assay of radioactivity of sea-food products, and determination of permissible levels of radioactivity from sea-food sources. (H.H.D.)

20083 STUDIES WITH RADIOACTIVE GOLD. J. S. Lawrence (Salford Royal Hospital, Manchester, Eng.). Ann. Rheumatic Diseases, 20: 341-52(Dec. 1961).

Ten patients with rheumatoid arthritis were given a single intramuscular injection of 10 mg aurothiomalate con-

taining Au^{199}, and distribution of Au throughout the body was followed by scintillometry. Four of these subjects were responsive to the therapeutic benefits of Au, 3 were resistant, 2 had developed hypersensitivity to Au, and 1 had never received Au therapy. The plasma level of Au varied from 0.11 to 0.17 mg/100 ml on the 1st day and fell thereafter to a mean value of 0.02 by the end of the 2nd week. Lowest plasma levels were encountered in the 2 patients hypersensitive to Au. The slowest fall in plasma Au level occurred in the 2 patients resistant to Au therapy, but no correlation was found between plasma Au concentration and activity of the arthritis. The blood level of Au was directly proportional to the dose given as shown by the fact that in 2 patients given Au^{198} mixed with inactive Au, instead of Au^{198} alone, the plasma levels of Au^{198} were the same as in the other 8 subjects. Au in plasma appeared to be completely bound to protein, mostly to fibrinogen. The red cell concentration of Au varied from one-quarter of the plasma level on the 1st day to a value equal or greater than the plasma level by the end of the 2nd week. Concentration of Au in synovial fluid was slightly less than in plasma at the end of the 1st week, but became equal to or greater than the plasma level by the end of the 2nd week. Fluid and fibrin clot from a popliteal bursa removed at operation showed a Au concentration of 0.67 mg/100 ml while the plasma level was 0.01 mg/100 ml. Biopsied articular cartilage showed a similar high Au content from the same patient. The injected Au was excreted slowly in urine, 15% in the 1st week and 20% by the end of the 2nd, after which time excretion became very low. Excretion was more rapid in patients with sensitivity reactions, but it was unrelated to disease activity or response to therapy. The highest scanning counts of radioactivity were found over the right hypochondrium, except for the injection site, but high counts were also noted over the left hypochondrium, pectoral regions, and loins. In the limbs the counts were greatest proximally and diminished as the scanner moved peripherally. Of the 70 joints scanned, 40 gave counts similar to nonarticular regions, 6 gave lower, and 24 gave higher counts than those expected. Painful joints gave high counts 2.5 times more often than symptomless joints. This finding was not limited to the time immediately following the injection but persisted when the blood Au level had become negligible. It is suggested that Au compounds have a local beneficial effect on inflamed tissues by inhibiting enzymes involved in the inflammatory process. (H.H.D.)

20084 THE DISTRIBUTION AND EXCRETION OF RADIOACTIVITY AFTER ADMINISTRATION OF ^{35}S-LABELED PERPHENAZINE (TRILAFON). S. Symchowicz, W. D. Peckham, M. Eisler, and P. L. Perlman (Schering Corp., Bloomfield, N. J.). Biochem. Pharmacol., 11: 417-22(June 1962).

S^{35}-perphenazine of high specific activity was synthesized, and the identity and radiochemical purity of the product were established. Tissue distribution and excretion of radioactivity were studied in rats after subcutaneous injection of 0.3 mg of S^{35}-labeled perphenazine dihydrochloride/kg body weight. Maximal concentrations of radioactivity were found in most tissues after 1 hr. Tissues showing the highest peak concentrations were lung, adrenal, liver, kidney, spleen, and pituitary, while the brain parts had somewhat lower, but appreciable, amounts. Blood levels were consistently low. High levels of radioactivity were found in the pituitary gland after 48 hr and remained relatively high even after 6 days. Over 80 per cent of the drug was excreted during a period of 24 hr; most of this (80 per cent) was excreted in the feces, while only 20 per cent could be found in the urine. Experiments performed with female rats in day 19 of pregnancy showed small amounts of radioactivity crossing the placenta. After 24 hr, however, the concentration of radioactivity in the fetus and amniotic fluid was extremely low. (auth)

20085 INVESTIGATIONS ON THE EFFECTIVE HALF LIFE OF I^{131} IN THE THYROID. H. J. Maurer (Stadt. Krankenhauses, Bad Oeynhausen, Ger.). Fortschr. Gebiete Röntgenstrahlen u. Nuklearmed., 96: 129-35(Jan. 1962). (In German)

Measurements carried out during I^{131} tests on the thyroid gland showed: (a) two types of storage independent of the functional state of the thyroid gland; (b) calculations concerning the effective and biological half life are significantly influenced by this; and (c) estimations of the effective half life can be made sufficiently accurate only by measurements over a period of 12 days. The reasons for these phenomena are discussed. (auth)

20086 ADVANTAGES OF IRON BEAM FILTERS IN THE VOLTAGE RANGE OF X-RAY DIAGNOSIS. H. Boesche and W. Frik (Universität, Erlangen-Nürnberg). Fortschr. Gebiete Röntgenstrahlen u. Nuklearmed., 96: 136-40(Jan. 1962). (In German)

The substitution of iron filters for aluminium filters of similar HVL results in increased doses with the same electrical input factors. This has already been demonstrated by measurements in free air. These findings have now been confirmed in experiments using 60 to 150 kv with an object of 20 cm water equivalents and conditions resembling those in actual practice. The increase in dose varies between 6% and 20%, depending on kv and thickness of object. It has particular advantages for screening in reducing the load on the tube. Finally, the advantages of using zirconium at 200 kv are pointed out. (auth)

20087 INVESTIGATIONS ON FILM PHOTOGRAPHIC TECHNIQUES WITH COBALT GAMMA BEAMS. W. Bohndorf and D. Harder (Universität, Würzburg, Ger.). Fortschr. Gebiete Röntgenstrahlen u. Nuklearmed., 96: 288-96(Feb. 1962). (In German)

Experiments were carried out to obtain best results in the direct radiographic check of field positioning in telecobalt therapy. By using highly sensitive fine-grain films of high contrast it is possible to obtain radiographs which permit a satisfactory assessment of the situation on the focus of disease with exposure times of 1 to 3 sec. Industrial films in combination with salt and lead screens have proved to be particularly suitable. (auth)

20088 THE CLINICAL APPLICATION OF GAMMA-BEAM RADIOGRAPHY IN TELECOBALT FIELD CONTROL. W. Bohndorf, D. Harder, and G. Bonse (Universität, Würzburg, Ger.). Fortschr. Gebiete Röntgenstrahlen u. Nuklearmed., 96: 297-304(Feb. 1962). (In German)

An account is given of the advantages of checking the positioned field with the help of radiographs taken directly with the source of radiation used. By choosing suitable film and screen combinations (lead screens or high definition screens) sufficient contrast is obtained even with Co-60 gamma rays. The radiographs thus produced differ in character from the conventional radiographs and must be interpreted in a way similar to that required for high kv radiographs. Radiographs consisting of the superposition of one picture obtained with fully opened diaphragms for general orientation and a second exposure on the same film with the planned size of field increases the accuracy of positioning in telecobalt treatment considerably. They provide a simple check of size and alignment of the field within its surroundings. (auth)

20089 RADIATION BURDEN IN CARDIO-RADIOLOGICAL DIAGNOSIS. D. Bachmann (Freie Universität, Berlin). Fortschr. Gebiete Röntgenstrahlen u. Nuklearmed., 96: 636-8(May 1962). (In German)

The somatic radiation doses received during 85 cardiac catheterizations and 35 angiocardiograms were estimated to be 9.2 r and 3.5 r respectively. (auth)

20090 SALTS OF URANYL INTERACTION WITH VEGETABLE TISSUE COMPONENTS AND SEVERAL OF ITS DERIVATIVES. P. F. Andreev, I. V. Andpeeva, and E. M. Pogozina. Geokhimiya, No. 4, 313-17(1962). (In Russian)

Data on uranium, lead, and molybdenum salt extraction by cellulose, lignin, wood, oxicellulose, and other compounds from diluted solutions, depending on concentration and pH, are given. A main part of the extracted U is bound by coordinated complexes and only a small part is extracted by ion exchange on carboxyl groups. It is postulated that U accumulation is prevented by a certain mechanism in plant's organism. (auth)

20091 THE INCORPORATION OF P-32 IN SOME PHOSPHORATED HEART FRACTIONS OF AGED RATS. E. Robillard (Univ. of Montreal). Intern. J. Appl. Radiation and Isotopes, 13: 117-21(Mar. 1962). (In French)

The incorporation of P-32 and content of phosphorus in some phosphorus fractions of the heart were examined in one- and two-year old rats at rest and after a strenuous exercise. The rate of incorporation of P-32 was found higher in creatine phosphate than in adenosine triphosphate during the rising phase of the phosphorus uptake in one-year old rats at rest but not in two-year old ones. No difference was found between the two age groups after exercise except that the one-year old animals required a greater work load than the two-year old ones to become exhausted. (auth)

20092 STUDY OF THE RADIOCURABILITY OF INITIATING PRIMARY LESIONS IN THE GROUP OF RADIOSENSITIVE CANCERS. CUTANEOUS EPITHELIOMAS AND EPITHELIOMAS OF THE UTERINE CERVIX. H. Dancot (Institut J. Bordet, Brussels). J. belge radiol., 45: 51-65 (1962). (In French)

A study of the results obtained after irradiation of the initiating primary lesions in epithelioma of the skin, and epithelioma of the uterine cervix allows the following conclusions: adding up the total number of lesions persisting after irradiation, and the early and the late recurrences, no more than 4% of the cases treated in both groups is obtained, provided an adequate treatment has been applied. These failures can not be attributed to the histopathological type. Nor can it be certified that some are due to a primary radioresistance of the irradiated primary lesion; the very existence of such a radioresistance seems uncertain. The more numerous failures of the past and even those of today seem to be due to an insufficiency of the methods or to technical errors, a combination of both being, of course, always possible. The part played by the dose delivered to the lesions has been clearly demonstrated in epithelioma of the skin; local failures diminishing progressively with increasing doses. (auth)

20093 DOSE DIFFERENCES IN INTERSTITIAL THERAPY. Paul de Plaen. J. belge radiol., 45: 83-7 (1962). (In French)

Dose differences in a given point of radium needle implants are most correctly estimated when considering the minimum dose point and not the point itself. In such conditions it will be observed that one single erratic needle does not essentially influence the dose distribution. (auth)

20094 STUDIES ON THE PATHOGENESIS OF MENINGITIS. I. INTRATHECAL INFECTION. Robert G. Petersdorf and Charles N. Luttrell (Johns Hopkins Univ., Baltimore). J. Clin. Invest., 41: 311-19(Feb. 1962).

Meningitis was produced in dogs by inoculation with 10^3-10^6 type III pneumococci via the subarachnoid space. This produced an infection lasting 48-96 hrs and characterized by cerebrospinal fluid (CSF) changes, including an increase of leukocytes and bacteria and a decrease in glucose concentration. This concentration was inversely related to the cell and bacteria counts of CSF. Pretreatment for 5 dogs with prednisolone did not alter the course of infection. When leukopenia was produced by 450 r whole-body irradiation, the number of inflammatory cells in the CSF was reduced in infected animals and survival was prolonged. This indicates that exudation into the subarachnoid space may have a harmful effect on the ventricular cavities where it may cause hydrocephalus. (H.H.D.)

20095 THE KINETICS OF PARENTAL DEOXYRIBONUCLEIC ACID (DNA) REPLICATION, DEOXYGUANYLATE KINASE FORMATION, AND P^{32}-INACTIVATION OF THE PARENTAL VIRUS IN ESCHERICHIA COLI INFECTED WITH BACTERIOPHAGE T4. Andrzej W. Kozinski and Maurice J. Bessman (Johns Hopkins Univ., Baltimore, Md.). J. Mol. Biol., 3: 746-55(Dec. 1961).

The kinetics of deoxyguanylate kinase formation and DNA replication were followed in E. coli grown in a medium containing 5-bromouracil and after infection of the cells with P^{32}-labeled T4 phage. Transfer of radioactivity to DNA of high mol wt, estimated by ultracentrifugation in CsCl density-gradient solution, was taken as an indication of replication. Three min after infection when no replication was evident, significant enzyme synthesis had occurred, and by 6 min when only a small fraction of the P^{32} had shifted to high mol wt DNA, 80% of the enzyme had been formed. Enzyme formation was unaffected but DNA synthesis did not occur when the bacteria were infected with ultraviolet-inactivated phage. These results are consistent with the concept that DNA replication is not a prerequisite to enzyme synthesis in phage-infected cells. If T4 phage heavily labeled with P^{32} was used under the same conditions for infection, the stabilization of the parental DNA to P^{32} decay occurred before DNA replication. This confirms that stabilization is not dependent on the prior replication of DNA. (H.H.D.)

20096 AN ESTIMATE OF THE LENGTH OF THE DEOXYRIBONUCLEIC ACID (DNA) MOLECULE OF T2 BACTERIOPHAGE BY AUTORADIOGRAPHY. John Cairns (Australian National Univ., Canberra). J. Mol. Biol., 3: 756-61(Dec. 1961).

T2 phage labeled with thymidine-H^3 or thymine-H^3 underwent inactivation when stored at 4° at a rate directly proportional to the specific activity of the label. The number of lethal thymine methyl H atoms per phage particle was calculated to be 4×10^4, which when corrected for the nonisotopic thymine from the bacterial pool of DNA, raises this value to 5×10^4. Thus the efficiency of suicide of phage from H^3 decay is the same as that previously found from P^{32} decay. This is an unexpected finding since H^3 and P^{32} differ greatly with respect to the energy of the electrons they emit (17 and 1700 kev), and their sites of incorporation in DNA are markedly different. Autoradiography of T2 DNA, labeled with thymine-H^3 and extracted in the presence of a 1000-fold excess of unlabeled DNA, shows that the molecule can assume the form of an unbranched rod ~52 μ long. This indicates a mol wt of 110×10^6 and a P

content of 3.0×10^5, if a value of 3.4 Å per base pair and 357 as the average mol wt of a base are assumed. (H.H.D.)

20097 THE ROENTGENOFLUORIMETRIC DETERMINATION OF INORGANIC CONSTITUENTS IN BIOLOGIC MATERIALS. I. BASIS, TECHNIQUE, AND LIMITATIONS OF THE METHOD. K. Beyermann and K. Cretius (Universität, Mainz). Klin. Wochschr., 40: 86-9(Jan. 15, 1962).

A semi-automatic, direct recording apparatus is described and applied to determination of elements in serum and tissues. Elements with atomic numbers above 22 can be determined directly whereas elements 13-21 require a special vacuum apparatus. The sensitivity and reproducibility of the method for analyses of the following elements in muscle are tabulated: Ca, K, Cl, S, P, Si, Al, Mg, Tl, Hg, Cr, Se, As, Cu, U, Bi, Zn, Br, Fe, Rb, Sr, and Mn. (H.H.D.)

20098 THE ROENTGENOFLUORIMETRIC DETERMINATION OF INORGANIC CONSTITUENTS IN BIOLOGIC MATERIALS. II. DETERMINATION OF Br, Fe, AND Zn IN SERUM AND HUMAN MUSCLE AS AN EXAMPLE OF THE APPLICATION OF THE METHOD. K. Cretius and K. Beyermann (Universität, Mainz). Klin. Wochschr., 40: 89-97(Jan. 15, 1962).

Determination of Br in normal serum by this method gave a mean value of 2.2 μg/ml with a range of 0.7-13.3 and a rather high mean error of ±0.5. In pregnant women, the serum level was 1.5 μg/ml. The Fe and Zn levels in normal serum were 1.5 and 1.5 μg/ml. The respective Br, Fe, and Zn levels in human muscle were (as μg/100 mg dry wt): skeletal muscle 2.3, 28.6, 18.3; body of the uterus 2.9, 14.9, 5.9; and uterine isthmus 2.2, 12.3, 4.7. The results indicate that Fe and Zn are higher in myometrium than in skeletal muscle. (H.H.D.)

20099 THE USE OF RADIOACTIVE COLLOID GOLD IN THE COMBINED TREATMENT OF LUNG CANCER. A. N. Novikov, M. A. Volkova, and E. S. Kiseleva (Gertsen State Onkological Inst., USSR). Med. Radiol., 7: No. 4, 8-12(Apr. 1962). (In Russian)

Radioactive colloidal gold was employed in cancer of the lung in conjunction with a radical operation (pulmonectomy or lobectomy) for the purpose of direct radiation action on the tumorous elements, disseminated in the extensive zone of the lymphatic system of the pleura, lung, and mediastinum. Clinical observations revealed that the employment of radioactive gold causes no deleterious effect on the general state of patients and the hematopoietic system; it does not aggravate the operation or the postoperative period. (auth)

20100 THE RESULTS OF USING RADIOIODINE FOR STUDIES OF THE FUNCTIONAL STATE OF THE THYROID GLAND IN CARDIOVASCULAR AND ALIMENTARY DISEASES. I. T. Kalyuzhnii (Kirgiz Medical Inst., USSR). Med. Radiol., 7: No. 4, 25-9(Apr. 1962). (In Russian)

The thyroid function in 60 healthy persons and 2000 patients was assessed. An elevated capacity of the thyroid gland to concentrate radioiodine was observed in almost 50% of rheumocarditis patients, one-third of lamblious cholecystitis cases, one-fourth of patients with rheumatic disease of the heart and circulatory insufficiency of the 1st and 2nd degrees, and more rarely in patients with neurosis, peptic ulcer, and hypertensive vascular disease of the 1st stage. Moderately low indexes of radioiodine accumulation in the thyroid gland were found in patients with subacute septic endocarditis, in two-thirds of patients with atherosclerosis and hypertensive vascular disease (2nd and 3rd stages), in half of cases with rheumatic heart disease and circulatory insufficiency of the 3rd degree, as well as in pulmonary heart, chronic gastritis, and ulcerous disease. (auth)

20101 INVESTIGATION OF THE METABOLIC RATE OF POTASSIUM AND SODIUM IN ERYTHROCYTES IN CARDIAC INSUFFICIENCY BY MEANS OF LABELLED ATOMS. Z. M. Belova (Sechenov Order of Lenin Inst. of Medicine, Moscow). Med. Radiol., 7: No. 4, 30-5(Apr. 1962). (In Russian)

Potassium and sodium metabolism in erythrocytes of healthy persons and patients with cardiac insufficiency was assessed. The rate and nature of potassium and sodium exchange in patients with cardiac insufficiency depend on the degree of hemodynamic disturbances and the treatment employed. It is recommended that investigations of this type be carried out as a supplementary test for the evaluation of cardiac insufficiency, and the indications and the effectiveness of treatment with hormonal and diuretic preparations. (auth)

20102 CHANGES IN THE FUNCTIONAL STATE OF THE THYROID GLAND AS A MANIFESTATION OF GENERAL RADIATION REACTION IN THE TREATMENT OF PATIENTS WITH CANCER OF THE UTERINE CERVIX. N. A. Pisareva. Med. Radiol., 7: No. 4, 79-80(Apr. 1962). (In Russian)

A considerable increase in thyroid I^{131} accumulation was observed in 39 of 67 patients during acute general reaction to radiotherapy of cervical carcinoma. However, the thyroid gland remained unchanged in patients exposed to radiotherapy of cervical carcinomas after they had passed their menopause. (R.V.J.)

20103 VARIATION OF YEAST RIBOSOMES WITH NUTRITIONAL STATE. J. K. Koehler (Univ. of California, Berkeley). Nature, 194: 757-9(May 26, 1962).

Ultracentrifugal and electron microscopic data are presented on ribosomes from cells of baker's yeast which were cultured in nutrient and starving media. The sedimentation patterns show that the γ- or 65S-peak is present only in the growing ribosomes. Some of the ribosomes were irradiated with x rays in an attempt to split some of the components; little or no change occurred in the sedimentation constants. The results are discussed with respect to the theory of ribosomes being the synthetic site for cellular proteins and to the role of the 65S yeast ribosome, and comparative structures and sedimentation rates are given for ribosomes of E. coli and yeast. (D.L.C.)

20104 A POOL SIZE PROBLEM ASSOCIATED WITH THE USE OF TRITIATED THYMIDINE. Alison Newton (Univ. of Cambridge, Eng.), P. P. Dendy, C. L. Smith, and P. Wildy. Nature, 194: 886-7(June 2, 1962).

During the investigation of variations in the amount of DNA per HeLa cell during the course of infection with herpes virus, results which can be attributed to a marked variation in size of nucleotide pool during the course of the experiments was obtained. Four experiments relevant to the discovery are discussed. It is concluded that even though DNA synthesis (probably induced by the virus) is rapid during the 6 to 10 hr period, the tritiated thymidine is only a small fraction of the nucleotide pool. Hence the rate of incorporation of label decreases continuously and in no way reflects the rate of DNA synthesis. This appears to be an extreme example of phenomena in which the effects of size of pool must be taken into account, and in this case the difficulty would arise even with low specific activity precursor. (P.C.H.)

20105 DOSIMETRY OF CAESIUM-137 IN SHEEP. R. O. McClellan, J. R. McKenney, and L. K. Bustad (Gen-

eral Electric Co., Richland, Wash.). Nature, 194: 1145-6 (June 23, 1962).

The relationship between radiation dose to whole body and that to gonads from internally deposited Cs^{137} was determined by dose measurements on young male sheep which were fed Cs^{137} for up to 20 days. The body burdens and individual tissue doses were measured after the last Cs^{137} feeding, and the sheep were then killed for Cs^{137} determination in the tissues. The highest dose rates were found on the rectum surface; the highest tissue dose rates, in the kidneys. The results, however, confirm the soundness of the policy of using total-body dose as an estimator of Cs^{137} radiation dose to the gonads. (D.L.C.)

20106 ABSORPTION OF RADIOSTRONTIUM BY THE GILLS OF FRESHWATER FISH. I. L. Ophel and J. M. Judd (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Nature, 194: 1187-8 (June 23, 1962).

Experiments were carried out in which the amount of Sr^{90} accumulated by goldfish, with only the head and gills immersed in the Sr^{90} solution was compared with that accumulated by goldfish totally immersed in the same solution. No feedings were given during the experiments which lasted for periods up to 24 hr. The results indicate that the head and gills are the main site of Sr^{90} sorption and that the exposure of the additional body surface in the total-immersion group results in only a small increase in the accumulated Sr^{90}. (D.L.C.)

20107 THE CONTAMINATION OF THE HUMAN PLACENTA WITH Sr^{90}. O. Pribilla, D. Merten, and U. Mutschke (Universitat, Kiel, Ger. and Institut der Bundesforschungsanstalt für Milchwirtschaft, Kiel, Ger.). Naturwissenschaften, 49: 18(1962). (In German)

The Sr^{90} content of human placentas was determined, and the values obtained were compared with the Sr^{90} content of the bones of newborn infants. The results showed that, as expected, a discrimination occurs in the passage of the calcium and Sr^{90} from the placenta to the bones. (J.S.R.)

20108 SATURATION OF MAMMALIAN BONES WITH STRONTIUM. Walter A. Mueller (Zweigniederlassung der Gesellschaft für Kernforschung m.b.H., Neuherberg, Ger.). Naturwissenschaften, 49: 38-9(1962). (In German)

The results of a study on the introduction of stable strontium into the skeleton of mice and a strontium saturation occurring from continuous overfeeding were reported. White mice were fed a normal diet enriched with Sr so that the weight proportion Sr/Ca was one, and the Sr/Ca ratio in the bones was determined in four mice every three to four days. The ratio increased from a normal value of 5×10^{-4} up to 1.5×10^{-2} after 12 to 14 days and remained constant as long as the Sr-enriched diet was continued. Another series of studies was made to determine the Sr saturation value in dependence on the age. The results are shown graphically. Pregnant mice fed the Sr diet produced young already dead or dying in the first days. (J.S.R.)

20109 Sr^{89}, Cs^{134} AND I^{131} TRANSFER AND DEPOSIT INTO THE HEN'S EGG. Oshima Masaharu and Hiroshi Nozaki. Nôgyô Gijutsu Kenkyûjo Hôkoku, G, No. 20, 225-36 (1961).

The transfer of radioactive Sr, Cs, and I, regarded as the most harmful nuclides in radiation hazard, into the hen's egg was studied after administration of these materials to laying White-Leghorn hens. Among these nuclides the total dose of the radiostrontium was the largest. Although the radiostrontium deposited mainly in the egg shell, some was found in the yolk and the white. The quantity of radiocesium which moved to the hen's egg was small, and the large part was in the egg white. The radiocesium content was much higher in the striated muscles than in the egg. Therefore, the contamination of the meat is more important than that of the egg in the laying hen. A considerable quantity of radioiodine accumulated in the egg yolk. As the yolk accumulated radioiodine to the same degree that the hen accumulated it (it takes about 10 days to complete the formation of the yolk in the ovary) the radioiodine content in the yolk had reached a large amount when the egg was laid. (Publ. Health Eng. Abstr.).

20110 THE DISTRIBUTION OF RADIOPHOSPHORUS IN RELATION TO PRENATAL OR POSTNATAL AGE IN THE RAT. Melvin R. Sikov (Wayne State Univ. Coll. of Medicine, Detroit). Phys. in Med. Biol., 6: 295-302(Oct. 1961).

The time-course of radiophosphorus concentration in the embryo or fetus was determined following intraperitoneal injection of the pregnant female at various times of gestation. The distribution of this phosphorus among the organs of the older fetuses was also measured. These data have been compared with the organ concentration curves obtained after injection of rats at various postnatal ages. (auth)

20111 THE RELATIVE BINDING OF CALCIUM AND STRONTIUM WITH SERUM PROTEINS AND OTHER SUBSTANCES. Charles W. Carr, Leon Singer, and Francis A. Spurrell (Univ. of Minnesota Medical School, Minneapolis and Univ. of Minnesota, St. Paul). Proc. Soc. Exptl. Biol. Med., 110: 80-3(May 1962).

Sera from various mammalian species, solutions of various fractions of serum proteins, and solutions of certain other substances were tested by ultrafiltration in the presence of Ca^{45} and Sr^{85} for their binding of Ca, and Sr. For 6 species, human, dog, horse, cow, sheep, and rat, the ratio, Ca bound/Sr bound, was 1.29, 1.14, 1.19, 1.15, 1.17, and 1.13, respectively. The absolute degree of binding shown by these species falls into 2 groups. The human, dog, and horse sera bound the 2 ions to a lesser extent, 57% Ca and 47% Sr; cow, sheep, and rat sera bound the ions to a greater extent, 69% Ca and 60% Sr. Ultrafiltration of various serum protein fractions of the human and bovine revealed that fraction V (albumin) showed no difference between the binding of Ca and Sr but differences were noted with the globulin fractions (IV, III, II) that could account for the discrimination observed in whole serum. Results of the ultrafiltration of a variety of other proteins and polyelectrolytes led to the speculation that mucoproteins in the serum globulins could account for the large fluctuations in binding of both ions by globulin fractions of various species; however, the results did not show any indication of the type of substance or chemical grouping which could account for the slight but persistent discrimination between Ca and Sr that has been observed in whole serum. (auth)

20112 A STUDY OF THE EXPLICIT DISTRIBUTION OF RADIATION IN INTERSTITIAL IMPLANTATIONS. I. A METHOD OF CALCULATION WITH AN AUTOMATIC DIGITAL COMPUTER. Marilyn Stovall and Robert J. Shalek (Univ. of Texas and Texas Medical Center, Houston). Radiology, 78: 950-4(June 1962).

A method is described for the computation of explicit isodose distributions in interstitial radiation implantations by an IBM 709 computer. Twelve dose levels in each of five planes through the implant may be obtained. The procedures are in routine use. (auth)

20113 RETENTION OF NEOHYDRIN-Hg^{203} AS DETERMINED WITH A TOTAL-BODY SCINTILLATION COUNTER.

Robert H. Greenlaw and Merton Quaife (Univ. of Rochester Medical Center, Rochester, N. Y.). Radiology, 78: 970-3 (June 1962).

The characteristics of excretion of Neohydrin labeled with radioactive mercury were studied in 6 persons over a period of nine days. The amount of radioactive material retained in the body was determined in a total body counter. A biphasic excretion curve is described. The first portion proceeds with the half-time of five and a quarter hours and accounts for the excretion of approximately 75 per cent of the tracer material. The remaining 25 per cent is lost from the body with a half-time of approximately seven days. (auth)

20114 Se^{75}-SELENOMETHIONINE FOR VISUALIZATION OF THE PANCREAS BY ISOTOPE SCANNING. Monte Blau and Merrill A. Bender (Roswell Park Memorial Inst., Buffalo). Radiology, 78: 974(June 1962).

The pancreas uptake of amino acids is a reflection of the rapid rate of synthesis of the digestive enzymes. From 5 to 10 per cent of most amino acids are found in the pancreas within an hour after administration. The chemical similarity of selenium and sulfur is so close that the substitution of Se^{75} for sulfur within a methionine molecule results in an analog which has all the properties of amino acids including incorporation into proteins. The physical properties of Se^{75} (half-life, 128 days; principal γ ray, 0.27 Mev) are well suited to scanning. Using Se^{75}-selenomethionine prepared by yeast biosynthesis, more than 50 patients have been scanned. Since the pancreatic tissue itself is not labeled, a protocol must be used which favors enzyme synthesis within the pancreas but avoids any stimulus which would cause pancreatic secretion. In addition, it appears that prolonged food deprivation (overnight or longer) favors uptake in the liver. The following procedure has been temporarily adopted: Three to four hours following a high protein breakfast, the pancreas is stimulated to empty by a dose of mixed secretin and pancreozymin; one hour later, 3 to 3.5 microcuries/kilogram of Se^{75}-selenomethionine are given intravenously, and scanning is started one half hour after injection. It has been possible to visualize the pancreas in about two-thirds of the patients scanned. To date, no scans have been done on patients with known pancreatic disease. The estimated dose to the patient from this procedure is about 0.6 rad, total body, delivered over several months. (auth)

20115 INHIBITION OF SELECTIVE ABSORPTION OF SUGARS BY THORIUM ION. M. Lluch and F. Ponz (Univ. of Barcelona). Rev. espan. fisiol., 17: 149-58(Dec. 1961).

The influence of Th^{4+} (added as $ThCl_4$) on the intestinal absorption of sugars was studied in rat intestine in situ. Solutions of sugars at 0.3M containing Th^{4+} at concentrations of 10^{-3} to 10^{-5}M were injected into the intestine and the sugar content of the solution was measured 30 and 60 min later. Th^{4+} at 5×10^{-4}M produced a 25 to 40% inhibition of absorption of D-glucose, D-galactose, and D-fructose; these sugars are normally absorbed selectively. In contrast, absorption of L-arabinose, which is absorbed by passive diffusion, was not inhibited by Th^{4+}. Thus Th^{4+} presumably interferes with enzymes in intestinal mucosa necessary for the transport of sugars. Th^{4+} could not be removed from intestinal mucosa by washing with 0.9% saline but could be removed by brief treatment with 1% ethylenediaminetetraacetate solution. Rinsing the intestinal lumen with this solution completely restored absorptive capacity for sugars following exposure of intestine to $ThCl_4$. The inhibitory effect of Th^{4+} found resembles that previously found for uranyl ion (ibid., 16: 327(1960)). (H.H.D.)

20116 DISAPPEARANCE OF SODIUM-24 FROM UTERINE MUSCLE AT THE END OF PREGNANCY. Robert Landesman and Robert Knapp. Rev. obstét. y ginecol. (Caracas), 20: 297-304(1960).

Na^{24} (0.8 μc) was injected into the myometrium of women in normal and toxemic pregnancy at term. In normal pregnancy, the mean half time for the disappearance of radioactivity from the uterus was 2 min with an upper limit of 6 min. In cases of toxemic pregnancy, this time was markedly prolonged, to as long as 88 min, and the activity-time curves showed a plateau effect. Contraction during labor tended to increase the disappearance rate, but the rate was not affected by injection of oxytocin. When blood pressure was lowered after the patient was placed in a supine position, the rate decreased; it then rose again when an upright position was assumed and normal blood pressure regained. (H.H.D.)

20117 INCREASED BLOOD VOLUME IN POLYCYTHEMIA VERA AND THE EFFECT ON IT OF TREATMENT WITH P^{32}. Tibor Burger, Bela Keszthelyi, and Janos Peer (Univ. of Pecs, Hungary). Z. ges. inn. Med. u. ihre Grenzgebiete, 16: 1048-52(1961).

The effect of this treatment was studied in 3 patients with polycythemia vera having hematocrits of 70-80% and red cell counts of $6\text{-}8 \times 10^6$. Plasma volume was also elevated and the red cell volume was decreased to 80-5 μm^3 from a normal mean of 87. After a single injection of 3-10 mc inorganic $P^{32}O_4$, subjective symptoms improved as well as the hematologic values. Hematocrit, hemoglobin, and counts of erythrocytes, leukocytes, and thrombocytes fell. Blood volume and viscosity also declined. (H.H.D.)

20118 THE KINETICS OF STRONTIUM METABOLISM IN THE SKELETAL SYSTEM AND THE MECHANISM OF BINDING OF STRONTIUM IN BONE. Albrecht Schmid (Universität, Munich). Z. physiol. chem., 326: 177-96 (Dec. 1961).

Comparative studies were made of the kinetics of Sr and Ca uptake by bone in immature and adult rats fed these elements for various periods up to 120 days. Numerous tables are provided showing Sr and Ca contents of compact and porous regions of femur and tibia of male and female rats of various ages. Changes in exchangeable fractions of Sr and Ca were found to follow an exponential course and to be inversely related to each other, i.e., uptake of Sr by bone depends on Ca removal and Ca uptake on Sr removal. After various periods of Sr feeding, the Sr + Ca level in serum remained practically the same as the initial Ca level. Equilibrium constants for the Sr-Ca exchange reactions were calculated. The half-time values (in days) for Sr elimination from bone of young male and female rats fed Sr for 30 days were 28.2, 24.7; young rats fed Sr for 120 days 34.6, 30.1; and adult rats fed Sr for 120 days 204, 187. Thus Sr is eliminated from bone more slowly in grown than growing animals, whereas bone of growing animals shows a 2-3 times greater capacity for Sr incorporation. Spongiosa took up more Sr than compact bone, but elimination of Sr occurred at equal rates in both types of bone. The results indicate that Sr is taken up at the surface of bone mineral by an ion-exchange reaction. A portion of the stored Sr is firmly bound in the skeleton and unavailable for free exchange, apparently because of interference by organic bone matrix in the exchange process. The data provided no evidence that Sr replaces Ca in the crystalline lattice of bone. (H.H.D.)

20119 UPTAKE AND DISTRIBUTION OF VANADIUM IN THE TUNICATE CIONA INTESTINALIS. Hans-Joachim Bielig, Karl Pfleger, Walter Rummel, and Ernst Seifen

(Max-Planck-Institut für Medizinische Forschung, Heidelberg). Z. physiol. Chem., 326: 249-58(Dec. 1961).

Blood cells of this organism contained 1.5 μg/mg dry wt but none could be detected in the plasma by the method used (emission spectrography). The Fe and Cu content of the cells was 0.8 and 0.2, and of the plasma 0.06 and 0.01 μg/mg dry wt. V, Fe, and Cu contents in various organs were: gastrointestinal tract 0.15, 0.24, 0.11 μg/mg dry wt; branchial sac + mantle 0.11, 0.19, 0.06; gonads 0.05, 0.16, 0.02; inner portion of tunic 0.004, 0.14, 0.008; and outer tunic 0.006, 0.8, 0.13. Uptake of V^{48}-vanadate by the tunicate showed a nonlinear relation to the V^{48} concentration of the sea-water medium; i.e., at higher V concentrations, uptake diminished. The largest amounts of V were taken up by gastrointestinal tract and brachial sac (especially by the blood cells therein), and the smallest amounts by gonads and tunic. Maximum uptake occurred at 6 hrs but some organ activity persisted up to 15 days. The plasma/blood cell ratio of V^{48} fell from 82 to 6 after 5-day incubation of blood. No Cr^{51}-chromate was taken up by the tunicate; Fe^{59} (ferric) was taken up by intestine and brachial sac at $\frac{1}{3}$ and $\frac{1}{2}$ that of V. Only $\frac{1}{30}$ as much Fe entered the blood as compared with V. (H.H.D.)

20120 ELEMENTY RADIATSIONNOI BIOKHIMII. (Elements of Radiation Biochemistry). N. F. Lipkan. Kiev, State Publishing House of Medical Literature, Ukrainian SSR, 1958. 160p.

Problems arising due to biochemical changes in organisms exposed to radiation are discussed. Metabolic change, fermentation, injuries, toxic effects, and prophylactic measures are considered. Some data on radioisotopes and their applications as tracers are analyzed. (R.V.J.)

Fallout and Ecology

20121 OBSERVATION OF FALLOUT AROUND OUR LABORATORY. Tetsuo Mamuro, Akira Fujita, Tadao Matsunami, Kazuko Yoshikawa, and Toshio Azuma. Ann. Rept. Radiation Center Osaka Prefect., 2: 1-9(1961). (In English)

Radioactivity measurements in 1961 are reported for the rain water, dusts collected in a basin, and weeds around the laboratory and for sea water from Osaka Bay. A small increase and a large increase in the activities were observed due to the spring maximum and the Russian nuclear explosions in the fall, respectively. (D.L.C.)

20122 OBSERVATION OF RADIOACTIVE AIR-BORNE DUSTS. Tetsuo Mamuro, Akira Fujita, Tadao Matsunami, Kazuko Yoshikawa, and Toshio Azuma. Ann. Rept. Radiation Center Osaka Prefect., 2: 10-19(1961). (In English)

Radioactivity measurements on air-borne dusts are reported for the period after the beginning of the Russian nuclear explosions in Sept. 1961. The debris from nuclear explosions was detected by counting the samples 4 and 10 days after sampling. Debris was first detected in Osaka on Sept. 12, and two abnormal activity increases were observed on Oct. 30 and Nov. 7-8. Autoradiographs of air-borne dusts collected on large filter papers showed that strongly radioactive particles were present and that the dust activities were non-uniform. Autoradiographs of wild arrowroot leaves and a polyvinyl chloride sheet left outdoors are also reported. Gamma spectrum studies indicated that the radioactive elements in the dusts are almost the same as those produced in past H-bomb explosions. The decay characteristics of the dust samples of Oct. 30 and Nov. 7-8 indicate that their activities were produced by the explosions of Oct. 23 and 30, respectively. (D.L.C.)

20123 MEASUREMENT OF ^{137}Cs CONCENTRATION IN THE SEA WATER OF OSAKA BAY. Kazuko Yoshikawa, Tetsuo Mamuro, and Toshio Azuma. Ann. Rept. Radiation Center Osaka Prefect., 2: 20-3(1961). (In English)

About 200 liters of surface water were collected from Osaka Bay on July 24, 1961, and the Cs^{137} concentration was determined to be 0.35 μμc/l. (D.L.C.)

20124 FALL-OUT AND LIVESTOCK—SOME OBSERVATIONS ON THE SITUATION AS IT APPEARS TODAY. William G. Wisecup. J. Am. Vet. Med. Assoc., 140: 236-40 (Feb. 1, 1962).

Milk from exposed animals or from animals utilizing contaminated pastures should not be consumed by infants or youngsters. It may be used as animal feed. Food and other products that are in intact packages, cans, bottles, or cases can be brushed, vacuum cleaned, or washed and the contents utilized. If nothing else is available, it will be necessary to use the least contaminated materials. (Publ. Health Eng. Abstr.).

20125 IODINE^{131} FALLOUT MEASUREMENTS IN SHEEP AND CATTLE THYROIDS IN EGYPT, U.A.R., DURING THE PERIOD MAY 1956-JUNE 1957. A. Halawani and M. Y. Tamami (Inst. Research Trop. Med., Cairo). J. Egypt. Med. Assoc., 44: 263-74(1961).

Most of the animal thyroid glands examined by scintillometry after May 1956 showed detectable activity due to I^{131}, presumably originating from fall-out from nuclear weapons tests. The average content of thyroid I^{131} varied from 2.2 μμc/g in May 1956 to 973 in May 1957, and the concentration rose progressively during this period. The highest value found was 2690 μμc/g thyroid. Peak activities were observed in October 1956 and January and May 1957. The values were higher in cattle and sheep than in buffalo, which may be explained by the fact that the first 2 species were maintained on fodder or by grazing and the latter by feeding cottonseed cake, which is less likely to be contaminated by fall-out. In cattle less than 1 year old, the thyroid activity was about twice that of adult cows, whereas in suckling buffalo (less than 40 days old) it was 15 times higher than in adult buffalo. Cow's milk also showed significant radiocontamination during this period. Total radioactivity values as detected by a scintillation counter with reference to an I^{131} standard, varied up to 35.2 μc/l, with an average of 7.27. The decay pattern in milk suggested the presence of a mixture of radioisotopes. (H.H.D.)

20126 IODINE-131 AND OTHER FISSION PRODUCTS IN DRINKING-WATERS. R. E. Bentley (Inst. of Cancer Research, Royal Cancer Hospital, London), R. P. Parker, D. M. Taylor, and Mary P. Taylor. Nature, 194: 736-7 (May 26, 1962).

Samples of drinking water drawn in Oct. 1961 to Feb. 1962 from various parts of England and Wales were analyzed for I^{131}, Ru^{103}, and Zr^{95} + Nb^{95} with an ion exchange technique. The highest activities measured, 1.8 μμc/l I^{131}, 5.9 μμc/l Ru^{103}, and 9.5 μμc/l Zr^{95} + Nb^{95}, were in samples of water drawn from the River Thames at Sutton Courtenay, Berkshire, at a point upstream from the site of effluent discharge from the Atomic Energy Research Establishment at Harwell. All the activities were very much less than the maximum permissible concentrations, and it is concluded that the hazards from the ingestion of these isotopes are negligible. (D.L.C.)

20127 INTAKE OF IODINE-131 FROM MILK IN ITALY DURING THE PERIOD OCTOBER—DECEMBER 1961. A. Cigna and C. Polvani (Comitato Nazionale per l'Energie Nucleare, Rome). Nature, 194: 1123-8(June 23, 1962).

Determinations of I^{131} concentrations were carried out in

Oct. to Dec. 1961 on milk distributed to 13 cities representing 1/8 of the entire Italian population. The averaged results are presented for 3-day intervals; a peak was found at about the middle of Nov. following a rainy period. An integral of the daily I^{131} intake was drawn for a person fed with 1 liter of milk daily, and the total 3-month I^{131} intake per person is 8,600 pc. (D.L.C.)

20128 STRONTIUM-90, CESIUM-137, AND PLUTONIUM-239 IN HAY SAMPLES FROM 1953 TO 1961. Adolf Kloke and Friedrich Ludwieg (Institut für Nichtparasitare Pflanzenkrankheiten, Berlin). Naturwissenschaften, 49: 65-6(1962). (In German)

The three radioisotopes Sr^{90}, Cs^{137}, and Pu^{239} were determined in hay samples in Germany from 1953 to 1961, and the results were tabulated. (J.S.R.)

20129 BULLETIN OF THE ATMOSPHERIC RADIOACTIVITY, NO. 26, JULY-SEPTEMBER, 1961. Tokyo, The Japan Meteorological Agency, 1961. 86p. (In English and Japanese)

Tables are given for the radioactivities of standard U_3O_8 samples, rain, and dusts measured at a large number of Japanese stations on July 1 to Sept. 30, 1961. (D.L.C.)

Radiation Effects on Living Tissues

20130 (NP-11741) THE INFLUENCE OF DIETARY DEFICIENCIES ON THE SURVIVAL OF ALBINO RATS AND MICE SUBJECTED TO CONTINUOUS LOW INTENSITY RADIATION. Progress Report, March 1959–February 1960. Sidney O. Brown (Texas. Agricultural and Mechanical Coll., College Station. Engineering Experiment Station and Texas. Agricultural and Mechanical Coll., College Station. Research Foundation). Mar. 1, 1960. 89p.

Research data, having both medical and surgical implications, are presented on the effects of dietary deficiencies on the survival of albino mice and rats subjected to continuous low intensity radiation. The data presented are for the following investigations: chronic gamma irradiation effects on the weight increment of albino rats deficient in protein, chronic radiation effects in the survival of vitamin-deficient Swiss albino mice, survival of chronically irradiated mice maintained on pantothenic acid-deficient diets, chronic gamma radiation effects on avitaminotic albino rats, chronic whole-body irradiation effects on the hematology of the albino rats, blood glucose and eosinophils in the albino rat exposed to continuous low-dose gamma irradiation, and the effect of pre- and post-natal irradiation on the development of the albino rat. (N.W.R.)

20131 (UR-575) RADIATION INDUCED REGRESSION OF THE MURPHY-STURM LYMPHOSARCOMA. Edmond S. Copeland (Rochester, N. Y. Univ. Atomic Energy Project). Feb. 1, 1962. Contract [W-7401-eng-49]. 28p.

The effect of whole-body and tumor directed x irradiation on the transplantable Murphy-Sturm lymphosarcoma in the female Sprague-Dawley rat is reported. In experiments in which the whole rat, including the tumor, was irradiated with 250 kvp x rays, no dose was found that was curative and permitted the survival of the animal. A dose of 700 r was lethal to all animals within seven days. During this period, all tumors seemed to disappear, but even before the death of the animal some had begun to grow again. Lower doses led to partial regression of the tumor followed by regrowth. In experiments designed to study the effect of x irradiation on the tumor alone, the tumor dose required to produce complete tumor disappearance in all the animals to the end of the observation period (10 to 90 days after irradiation) was 2000 r. The dose producing 50% complete and permanent disappearance of tumors was between 1000 and 1250 r. When additional Murphy-Sturm transplants were made into animals cured of their tumors by irradiation, no permanent growth of the tumors occurred. (auth)

20132 (JPRS-13644) STUDY OF CERTAIN ASPECTS OF THE PATHOGENESIS OF RADIATION INJURIES OF THE SKIN. A. V. Kozlova, V. B. Zayrat'yants, N. P. Mordvinova, and I. B. Tsybul'skii (Tsybul'skiy). Translated from Med. Radiol., 7: No. 1, 16-21(Jan. 1962). 10p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 16, abstract no. 11478.

20133 ATOMIC BOMB RADIATION CATARACT IN NAGASAKI. Tsugihiko Tokunaga (Nagasaki Univ.). Acta Med. Nagasakiensia, 5: 24-42(Apr. 1960).

Ophthalmological examinations were conducted from 1953 to 1956 in 1600 persons aged 7-69 yr who were within 100-8000 m of the hypocenter of the explosion. The frequency of radiation-induced cataract was 57% (432 cases found in 753 subjects examined) within 1800 m of the hypocenter and 46% (463 out of 1010) within 2400 m. Lenticular opacities caused by radiation consisted of four types: (1) white, punctate opacities in the transitional zone, (2) vacuoles in the cortex of lens, (3) plaque-like opacities in the subcapsular region of the posterior pole, and (4) tuft-like opacities in the posterior polar cortex. Types 1 and 4 were found to be characteristic of radiation cataract whereas 2 and 3 were seen in other kinds of cataract. Type 3 was found in 7% of control subjects. Subclassifications of various types of radiation cataract are proposed and discussed. The degree of lenticular opacity appeared to be proportional to the radiation dose; incidence varied from 84% at 1100 m to 32% at 1700 m in a roughly linear fashion. Frequency and severity of cataract were also related to shielding and to other symptoms of radiation (especially epilation of scalp) but not age or sex. In persons exposed at 100-1600 m, those provided with good shielding such as an air-raid shelter or concrete building suffered fewer cataracts (39%) than those with poor shielding and incurring burns (71%). Visual acuity was not affected except in severe cases of cataract and in the later cases surgery was effective in restoring vision. No progression of cataract was noted during the 3-yr observation period. It was concluded that radiation-induced cataract generally has a good prognosis. (H.H.D.)

20134 ULTRASTRUCTURAL CHANGES IN THE SENSORY NERVE FIBERS IN THE SKIN OF THE FROG (RANA TEMPORARIA) AFTER CIRCUMSCRIPT IRRADIATION WITH Po^{210} α PARTICLES (5.3 Mev). A. M. Isomaeki, R. M. Bergstroem, and E. Kivalo (Univ. of Turku, Finland). Acta Pathol. Microbiol. Scand., 54: 190-202(1962).

The effect of ionizing radiation on the morphology and electrical activity of nerve fibers was studied with isolated fibers irradiated with 750-34,500 rep from a cylindrical Po^{210} source. Even the lowest dose of radiation caused intense swelling and vacuolation of Schwann cell cytoplasm, and at higher doses (10,000 rep) cytoplasmic structures are completely obliterated. In the axoplasm, neurofilaments retained their integrity up to 5000-rep doses and were destroyed at 20,000-rep doses. The most sensitive elements of axoplasm were the ergastoplasmic channels which were fragmented into vesicles at the lowest dose (750 rep). These elements could no longer be identified at higher doses. Axonal mitochondria were swollen and partially fragmented also by low doses. Myelin sheaths were destroyed by moderate doses (5000-20,000 rep), and after irradiation appeared as coiled or spiraled structures. Ac-

tion potentials of the nerve fibers were not affected by doses up to 2000 rep despite the morphologic changes which occurred, but after 5000 rep the potentials were almost completely depressed within 30 min after irradiation. It is suggested that the impairment of electrical activity of irradiated fibers is most closely related to the injury of ergastoplasmic channels and neurofilaments. (H.H.D.)

20135 THE ABSENCE OF EOSINOPHILIA IN RATS INFECTED WITH RADIATED TRICHINELLA SPIRALIS. Vito Scardino and Herman Zaiman (Albert Einstein Coll. of Medicine, New York). Am. J. Clin. Pathol., 37: 470-4 (May 1962).

By appropriate roentgen radiation, the reproductive capacity of T. spiralis larvae could be destroyed without eliminating their infectivity. The larvae were irradiated with 12,000, 16,000, or 20,000 r at a rate of 785 r per min. In contrast to rats infected with 6000 nonirradiated larvae, a similar number of larvae irradiated at the 2 lower doses failed to elicit eosinophilia, which was evident in the nonirradiated group on the 5th or 6th day after infection. Rats infected with larvae irradiated with 20,000 r developed eosinophilia on the 14th day. Moreover, larvae were recovered from muscle of the latter group of rats (but not from muscle of rats given larvae irradiated at the lower doses), indicating failure of radiation to cause reproductive sterilization at the 20,000-r level. This paradoxical finding may have resulted from an error in the irradiation technique. (H.H.D.)

20136 REPAIR OF ATOMIC, CATHODE-RAY, CYCLOTRON, AND X-RAY BURNS OF THE HAND; LONG-TERM FOLLOW-UP EXAMINATIONS AND MICROSCOPIC STUDIES. Minot P. Fryer and James Barrett Brown (Washington Univ., St. Louis). Am. J. Surgery, 103: 688-91(1962).

Medical and surgical treatment of such injuries is outlined and late results in several cases are described. The healed finger wounds were particularly susceptible to mechanical trauma and chemical, bacterial, and radiation injury, necessitating avoidance of subsequent exposure to such agents. Cases of cyclotron burns of the fingers are described and illustrated, in which the fingers were saved by early resection and grafting. (H.H.D.)

20137 IMMUNE RESPONSE IN RATS INFECTED WITH TRICHINELLA SPIRALIS LARVAE SUBJECTED TO ROENTGEN RADIATION. Herman Zaiman, Rudolph G. Howard, and C. Joyce Miller (Albert Einstein Coll. of Medicine, New York). Am. J. Trop. Med. Hyg., 10: 215-19 (Mar. 1961).

Experiments were conducted in rats on the immunogenicity of 500 T. spiralis larvae subjected to roentgen irradiation at doses varying from 0 to 20,000 r before injection in the rats. One month later the rats were challenged with 5000 nonirradiated larvae, and 2 months later the number of larvae in muscle were determined. The number recovered was found to increase linearly with the radiation dose, between 8000 and 20,000 r, applied to the larvae used for immunization. This indicates a progressive decline in immunogenicity with increasing radiation dosage in this range. However, larvae exposed to 8000 or 12,000 r were more potent immunologically than nonirradiated larvae. In rats which received only an immunizing inoculation of larvae, fewer larvae were found in muscle with irradiated than nonirradiated larvae, indicating that radiation limited the reproductive capacity of the worms. (H.H.D.)

20138 X-RAY INDUCED SEX-LINKED RECESSIVE LETHALS AND VISIBLES IN SCIARA COPROPHILIA. Helen V. Crouse (Columbia Univ., New York). Am. Naturalist, 95: 21-6(Jan.-Feb. 1961).

These mutations in the flies were investigated after irradiation of the sperm and oocytes in the first meiotic prophase, in male and female flies respectively. Irradiation of the males (sperm) showed that recessive sex-linked lethal mutations arise at a rate proportional to the radiation dose. For sperm irradiated at 2000, 3000, and 4000 r the lethal rates were 0.0136, 0.0303, and 0.0348. At 4000 r ~ the same lethal rate was obtained in oocytes (0.0437) as in sperm (0.0348); only the maxiumum dosage was employed in females since previous reports indicated that the oocyte chromosomes in first meiotic division of prophase are highly resistant to radiation-induced alterations. Two sex-linked recessive mutations resulted from irradiation of sperm (rate $^{2}/_{447} = 0.0044$), which is an appreciable visible rate in view of the fact that only 5 sex-linked traits have been heretofore reported in this species. The results show that Sciara is not resistant to the mutagenic action of x rays; the low yield of visible mutations in this species may be attributed to the unusual mode of inheritance and sex determination found in these flies. There is no correlation between the induction of chromosomal aberrations and the induction of sex-linked recessive lethals. When the latter are used as a criterion of sensitivity to x rays, the response of sperm and oocyte (first meiotic prophase) are similar. However, when chromosomal aberrations are used as a measure of sensitivity, sperm are highly sensitive and oocytes completely insensitive to radiation. (H.H.D.)

20139 IRRADIATION AND OVARIAN GRAFTS; ACTION OF VARIOUS DOSES OF X RAYS ON THE SUCCESS OF BREPHOPLASTIC OVARIAN GRAFTS IN MICE. Janine Thimotée and Raoul Michel May (Faculte des Sciences, Paris). Ann. endocrinol. (Paris), 23: 29-44(Jan.-Feb. 1962).

Ovaries from newborn C57 black mice or Swiss albino mice were grafted in the anterior chamber of the eye of castrated male and female mice of the same strain as the donor. These ovaries developed up to the cavitary follicle stage in castrated male and up to the formation of corpora lutea in castrated female mice. When similar grafts were made in mice of a different strain of that of the donor, the ovarian tissue was rapidly invaded by histiocytes, granulocytes, and lymphocytes and converted to a solid mass of fibrous connective tissue. These experiments were repeated in recipient C57 black mice irradiated with 300-1350 r. Destruction of the grafts was not prevented by doses below 600 r, and above 1000 r the mice died from radiation. After doses of 600-1000r the ovaries developed up to the cavitary follicle stage but did not produce corpora lutea or re-establish the estrus cycle. After 35 days the grafts of irradiated mice begin to degenerate and this process is complete by the 43rd day. There appeared to be a relation between the inhibition of antibody production and survival of the grafts by irradiation, and, it is suggested, failure of the grafts by the 35th day may reflect the recuperation of antibody-forming cells from radiation injury. (H.H.D.)

20140 ACTION OF POLONIUM-210 α PARTICLES ON ESCHERICHIA COLI K 12 (λ). R. Devoret (Institut Pasteur, Paris). Ann. inst. Pasteur, 102: 527-46(May 1962).

Studies were conducted in E. coli K 12 (λ), lysogenic for λ phage, and E. coli K 12 S, sensitive to λ phage and resistant to streptomycin. Radiation effects on the lysogenic system were investigated, particularly the survival and induction of K 12 (λ), length of the latent period, burst size of induced bacteria, capacity of infected K 12 S to reproduce λ, inactivation of λ phase, and survival of K 12 S. The number, distribution, and energy of α particles were computed from scintillometric dosimetry data. E. coli K 12 (λ) was

induced by α particles; the max. induction rate was 15-20% of irradiated bacteria. This limitation was not accounted for by capacity inactivation. For doses below 1 α particle per μ^2, the induction curve was linear and its slope was 1 when log-log values were plotted. The inducing action of 1 α particle could be demonstrated. Radiation effects of α particles differed from x rays in 2 ways: (1) induction by α rays always produced infectious centers, and (2) burst size of induced bacteria was far more sensitive to α rays than to x rays. For most of these properties, comparisons were made of the relative biological efficiencies of 4.3 Mev α rays and 15 kev x rays. (H.H.D.)

20141 MODIFICATION OF THE NEOPLASTIC CELLS PRESENT IN ASCITIC FLUID IN OVARIAN NEOPLASIA AFTER TREATMENT WITH RADIOACTIVE GOLD (Au^{198}); CYTOCHEMICAL STUDY. Sergio Avanzini (Università, Milan). Ann. Ostet. e Ginecol., 83: 1023-45(Dec. 1961).

In 6 women with metastatic ovarian carcinoma, cancer cells in ascitic fluid were studied by cytochemical techniques before and after intravenous injection of colloidal Au labeled with Au^{198} (50-275 mc). After radiotherapy, the cells showed regressive nuclear changes, with fragmentation, lysis, or pyknosis of nuclei. Secondary cytoplasmic changes also were noted, particularly vacuolization. The tumor cells before treatment showed large cytoplasmic deposits of periodic acid-Schiff reactive polysaccharide resistant to diastase, but after treatment this material was markedly diminished. No alkali phosphatase activity could be detected in the tumor cells before or after treatment. Cytoplasmic ribonucleic acid was diminished, indicating that protein synthesis may be reduced by irradiation of the tumor cells. (H.H.D.)

20142 DIRECT AND INDIRECT BIOLOGICAL EFFECTS OF RADIATION. Helmut Hobitz (Max-Planck-Institut für Biophysik, Frankfurt am Main). Arch. Hyg. u. Bakteriol., 145: 561-70(1961).

The primary physical processes, ionization and excitation, induced by radiation in biological materials are discussed. Their effects in causing reduction, decarboxylation, and depolymerization in proteins and deoxyribonucleic acid of the cell nucleus are examined. The action of radiation doses of 100,000-600,000 r on pollen of Digitalis purpurea maintained at room temperature and at −190°C showed that biological activity was destroyed by doses >200,000 r at room temperature, but at −190° the pollen retained some activity even after the highest dose. A similar effect was seen with Bacterium cadaveris cells, about 0.5% of which survived 50000 r given at −180° whereas no cells survived 20000 r given at 4°. The presence of 1% cysteamine at the higher temperature increased survival 20-fold. Cytochrome c showed markedly different responses to radiation in dry form as compared with aqueous solution. The anhydrous enzyme showed a linear decline in log activity with radiation dose but in aqueous solution the activity declined more slowly at higher doses. The radiation dose to produce 50% inactivation was 4×10^7 r in dry form and 6×10^5 r in solution, a 67-fold difference. The results suggest that diffusion of the free radicals (H: or OH:) produced in the primary process is considerably hindered at low temperature and by the absence of water. (H.H.D.)

20143 ACTION OF X RADIATION ON ADRENERGIC TRANSMISSION. Z. M. Bacq and M. L. Beaumariage (Centre Natl. Radiobiol. et Génétique, Liège). Arch intern. physiol. et biochim., 70: 111-12(Feb. 1962). (In French)

Contractions of the nictitating membrane of anesthetized cats produced by electrical stimulation were recorded during x irradiation of pre- and postganglionic fibers and ganglionic synapse. Brief irradiation with 190-650 r per min, directed toward the center of the membrane, did not modify the response of the smooth muscle to preganglionic stimulation. However, 10-30 min following doses of 10,000-40,000 r, an increased response to neural excitation was noted that paralleled the increased sensitivity to intravenous injection of adrenaline or nonadrenaline. Adrenalectomy did not modify these responses, and thus irradiation does not act in this instance by stimulation of the pituitary-adrenal system. The radioresistance of the nictitating membrane and adrenergic transmission is very high; function was maintained even with doses of 1,000,000 r delivered over 8 min or repeated doses of 100,000 over an 8-hr period. (H.H.D.)

20144 MODIFICATION OF THE RADIOSENSITIVITY OF ESCHERICHIA FREUNDII CULTIVATED IN THE PRESENCE OF FLUOROACETATE. C. Liébecq and P. M. Osterrieth (Université, Liège). Arch. intern. physiol. et biochim., 70: 125-7(Feb. 1962). (In French)

X irradiation (54,000 r in 3 min) killed 97% of a culture of the bacteria in control medium at pH 4.8 containing 0.5% glucose. The number of bacteria surviving irradiation was increased 5-fold in cultures containing 10^{-4} M Na fluoroacetate. In the latter cultures, ~1.5 times greater radiation doses were required to produce mortality equivalent to that in control cultures. These results are similar to those previously found in mice, in which 1.27 times as much radiation was required to produce a control mortality rate in mice injected with fluoroacetate (cf. Bacq et al., Radiation Res., 13: 286(1960)). (H.H.D.)

20145 DOES ROENTGEN RADIATION HAVE A SPECIFIC EFFECT ON THE RESORPTION TIME OF CUTANEOUS WHEALS? Carl Georg Schirren and Abdul Ghafar Motawakel (Universitat, Munich). Arch. Klin. Exptl. Dermatol., 214: 146-56(Nov. 1961).

In 148 patients undergoing roentgen therapy for skin diseases, physiologic saline containing a fluorescein indicator was injected intracutaneously and the time required for resorption of the wheal so-produced was evaluated in terms of the radiation dose (single doses of 100-500 r and total doses of 6000-8000 r). Irradiation markedly shortened resorption time, more than 50% at the highest dose, and in a dose-dependent way. However, this effect appeared to be a nonspecific one and attributable to the hyperemia and increased cutaneous circulation rate caused by irradiation. Thus, skin temperature also rose proportionally with the dose. Ultraviolet irradiation or application of a rubefacient agent (nicotinic acid benzyl ester) both produced a dose-dependent response of even greater magnitude than roentgen radiation. In patients with certain dermatitides and cutaneous tumors, the resorption time was much lower than in normal skin and x irradiation had very little additional effect in reducing this time. Thus the erythematous effect of inflammation and x irradiation appear to be manifested via the same processes. (H.H.D.)

20146 OXIDATION AND REDUCTION OF HEMOPROTEINS BY ULTRAVIOLET IRRADIATION. Jan Schuberth (Nobel Inst. of Medicine, Stockholm). Arkiv Kemi, 15: 97-130(1960). (In English)

Reaction mechanisms involved in the oxidation and reduction of hemoproteins by ultraviolet irradiation are discussed. The chemical processes leading to both anaerobic and aerobic ultraviolet reactions are considered. Data are included from a series of studies of ultraviolet effects on myoglobin, hemoglobin, cytochrome c, and hemoproteins.

The conversion of trivalent Fe to divalent Fe in hemoproteins exposed to ultraviolet light was demonstrated. It was concluded that the primary reaction in ultraviolet-reduction of hemoproteins is restricted to the protein part, and in all probability to one or more of the aromatic amino acid residues. This primary reaction does not produce any irreversible change in the protein. The primary reaction in ultraviolet-oxidation of hemoproteins is also probably restricted to the aromatic amino acids of the protein part. The participation of water in the reaction with the formation of OH-radicals is probably a condition for a reversible change in the protein. (C.H.)

20147 THE HISTOGENESIS OF RADIATION-INDUCED (Sr^{90}) SQUAMOUS EPITHELIAL CARCINOMA IN RAT LUNG. 1. CHANGES IN BRONCHIAL EPITHELIUM. H.-W. Altmann, R. Lick, and E. Stutz (Universität, Würzburg, Ger.). Beitr. pathol. Anat. allgem. Pathol., 125: 403-26(Dec. 1961).

Changes in bronchial epithelium were followed over a 6-month period in the lung of rats implanted with plexiglas capsules containing a mixture of Sr^{90} and Y^{90}. In bronchi of all calibers, squamous epithelial carcinomas arose from a process which began as basal cell hyperplasia, leading to a replacement of the normal cylindrical epithelial cells. Metaplasia and neoplasia of bronchial epithelium under the influence of Sr^{90} radiation is visualized as proceeding via the following steps: normal cylindrical epithelium → basal cell hyperplasia → transitional epithelium → resting squamous epithelium → proliferating squamous epithelium → invasive carcinoma. Carcinomas developed most rapidly in proximity to the radiation source. (H.H.D.)

20148 THE HISTOGENESIS OF RADIATION-INDUCED (Sr^{90}) SQUAMOUS EPITHELIAL CARCINOMA IN RAT LUNG. 2. THE ROLE OF ALVEOLAR EPITHELIUM. H.-W. Altmann, R. Lick, and E. Stutz (Universität, Würzburg, Ger.). Beitr. pathol. Anat. allgem. Pathol., 125: 427-44(Dec. 1961).

In the lungs of rats implanted with Sr^{90}-Y^{90} mixtures, alveolar cells underwent hyperplasia, metaplasia, and eventually neoplasia. Two types of cancer cells developed from irradiated alveolar cells: adenocarcinoma and squamous epithelial carcinoma cells. (H.H.D.)

20149 THE EFFECT OF ULTRAVIOLET IRRADIATION ON 5-FLUOROURACIL-PREHEATED BACTERIA. Ruth Ben-Ishai, Herzl Goldin, and Bina Oppenheim (Israel Inst. of Tech., Haifa). Biochim. et Biophys. Acta, 55: 748-54(May 14, 1962). (In English)

The response of 5-fluorouracil-grown Escherichia coli to ultraviolet irradiation was found to depend on the concentration of the analog present during preincubation. Low concentrations of 5-fluorouracil enhanced resistance to ultraviolet irradiation whereas higher concentrations reduced it. An attempt was made to study the mechanism of the 5-fluorouracil-induced resistance to ultraviolet irradiation. For this purpose the composition of the cells at the time of irradiation, the effect of reversing agents on survival, and the post-irradiation metabolism of 5-fluorouracil-pretreated bacteria were studied. The results obtained showed a correlation between the DNA content of a cell and its response to ultraviolet irradiation; they also indicated that 5-fluorouracil-pretreated cells became resistant to the action of ultraviolet light on DNA synthesis. The significance of these results is discussed. (auth)

20150 THE EFFECT OF ULTRAVIOLET IRRADIATION ON NUCLEIC ACID ISOLATED FROM TOBACCO MOSAIC VIRUS. David R. Coahran, Anne Buzzell, and Max A. Lauffer (Univ. of Pittsburgh). Biochim. et Biophys. Acta, 55: 755-67(May 14, 1962). (In English)

The effects of ultraviolet irradiation, mainly of 2537-Å wavelength, on RNA extracted from tobacco mosaic virus were studied. Breakage of RNA by irradiation was measured by use of the ultracentrifuge. The quantum yield for breakage of RNA in solution was calculated to be $3.5 \cdot 10^{-6}$ moles/einstein. Frozen RNA solutions, irradiated at dry-ice or liquid-nitrogen temperatures, gave a quantum yield for breakage of $8.1 \cdot 10^{-6}$. The heating to 68–70° of RNA solutions which had been irradiated at dry-ice or liquid-nitrogen temperatures increased the apparent quantum yields for breakage. The quantum yield for material irradiated at dry-ice temperature and heated was $2.0 \cdot 10^{-5}$, and that for material irradiated at liquid-nitrogen temperature and heated was $3.6 \cdot 10^{-5}$. The observed variations in quantum yield can be explained in terms of a model suggested by Doty et al. They suggest that the tobacco mosaic virus RNA strand has helical regions interspersed with regions of random coiling. A hydrogen-bonded secondary structure is believed to stabilize the helical regions. The quantum yield for biological inactivation of frozen RNA solutions irradiated at dry-ice temperature was $7 \cdot 10^{-4}$, in reasonably good agreement with the value of $3 \cdot 10^{-4}$ reported by McLaren and Takahashi for inactivation in solution. (auth)

20151 DECREASE OF SENSITIVITY TO ULTRAVIOLET RADIATION OF STREPTOCOCCUS FAECALIS GROWN IN MEDIA SUPPLEMENTED WITH 6-AZATHYMINE, AN ANALOG OF THYMINE. Helge L. Guenther and William H. Prusoff (Yale University School of Medicine, New Haven, Conn.). Biochim. et Biophys. Acta, 55: 778-80(May 14, 1962). (In English)

Streptococcus faecalis was grown in basal medium supplemented with thymidine, as well as two levels of azathymine, a non-inhibitory concentration and a level that resulted in 50% inhibition of growth. After incubation for 20 hr at 37°, the cells were harvested by centrifugation, washed once with saline, resuspended in saline, and adjusted to approximately the same turbidity. Ten ml of each suspension were placed in petri dishes and irradiated for various intervals of time with a 15-W General Electric germicidal lamp from a distance of 60 cm. The viability before and after irradiation was determined by serial dilution of the culture and plating of aliquots on micro-assay culture agar, using the surface-drop method. The agar plates were incubated in the dark for 18 hr at 37° and the number of evolved colonies were counted. There was no significant difference in the number of survivors after ultraviolet irradiation of cells grown in the absence of azathymine or in the presence of non-inhibitory levels of the compound. However, cultures grown in the presence of an inhibitory concentration of azathymine showed a 10-fold increase in resistance to the lethal effects of ultraviolet irradiation after 4 min of irradiation. (C.H.)

20152 RADIATION DOSES FROM ADMINISTERED RADIO-NUCLIDES. J. Vennart and Margaret Minski (Radiological Protection Service, Belmont, Surrey, Eng.). Brit. J. Radiol., 35: 372-87(June 1962).

When planning the administration of radionuclides for medical purposes it is important to estimate the radiation doses which will be received by several organs of the body as well as that received by the target organ. In order to make this estimate for any radionuclide, information is required about its uptake and retention in different organs of the body following its administration to the patient and

about the amount of energy absorbed in those organs following each of its disintegrations. Average values for these parameters for adult males are available in the Report of Committee II of the International Commission on Radiological Protection. This information has been used to compute values of the average radiation doses received by several organs of adult males following the ingestion or injection of 1 μc of most of the radionuclides at present used in hospitals. Details of the method of calculation and of the approximations employed are discussed so that the values of the radiation doses derived for adult males may be modified for other individuals, for example females and children, whenever the relevant metabolic data are available. Values of the parameters required in the calculation and of the radiation doses for adult males are tabulated. (auth)

20153 X-RAY DOSE-RESPONSE RELATIONSHIP FOR REPRODUCTIVE INTEGRITY OF VICIA FABA. E. J. Hall, L. G. Lajtha, and R. Oliver (Churchill Hospital, Oxford). Brit. J. Radiol., 35: 388-97(June 1962).

The pattern of recovery of root growth in Vicia faba after irradiation is discussed in terms of a theoretical model for the kinetics of the meristem population. On the basis of this model it is possible to deduce a dose response curve with respect to reproductive integrity for the meristematic cells from simple observations of root growth. (auth)

20154 A METHOD OF DEDUCING A DOSE-RESPONSE RELATIONSHIP FOR REPRODUCTIVE INTEGRITY OF CELLS EXPOSED TO RADIATION BY MEANS OF FRACTIONATION EXPERIMENTS. E. J. Hall (Churchill Hospital, Oxford). Brit. J. Radiol., 35: 398-402(June 1962).

A method is described for deducing the 37 per cent dose slope and the extrapolation number of the dose-response relationship for a cell population, from simple fractionation experiments. The method involves matching the effect of a pair of fractionated doses with a single equivalent dose, and repeating for two dose levels. Experiments are described in which the method is applied to Vicia faba. (auth)

20155 THE EFFECT OF CORTICOSTEROIDS ON THE RADIATION SKIN REACTION. A RANDOM TRIAL TO ASSESS THE VALUE OF LOCAL APPLICATION OF PREDNISOLONE AND NEOMYCIN OINTMENT AFTER X-RAY TREATMENT OF BASAL CELL CARCINOMA. K. E. Halnan (Christie Hospital and Holt Radium Inst., Manchester, Eng.). Brit. J. Radiol., 35: 403-8(June 1962).

A random trial was performed to compare the effect on the skin reaction of local application of Prednisolone and Neomycin ointment, Neomycin ointment, or no ointment after x-ray treatment of basal cell cancer in three groups of ten patients each. The area of moist desquamation was significantly lessened in the Prednisolone and Neomycin ointment group. It is suggested that topical application of a water miscible steroid and antibiotic ointment may be useful in clinical radiotherapy to sites such as the eye, groins, and perineum and where a severe and troublesome skin reaction might be expected. (auth)

20156 THE REMOTE AFTER-EFFECTS OF RADIATION ON HEMOPOIESIS. N. I. Shmeleva and G. V. Voskoboinikov (Central Research Inst. of Medical Radiology, Ministry of Health, Leningrad). Bull. Exptl. Biol. Med. (U.S.S.R.) (English Translation), 52: 1143-6(May 1962).

A study was made of the effects of radiation sickness in rats on hemopoiesis at various periods after irradiation. Data are tabulated on the blood picture and bone marrow at periods up to 360 days after irradiation. The rate of uptake of Fe^{59} and the osmotic resistance of the red cells were also measured. Normalization of the morphological picture of the peripheral blood and bone marrow 2 to 3 months after irradiation was of short duration and young forms were noted against a background of marked bone marrow and spleen hyperplasia 9 to 12 months after irradiation. (C.H.)

20157 THE EFFECT OF TOAD SKIN GLAND SECRETION ON THE PERMEABILITY OF TISSUES TO VITAL STAINS AFTER THEIR EXPOSURE TO EXPERIMENTAL ACUTE RADIATION. E. G. Dolgov (Semipalatinsk Medical Inst., USSR). Bull. Exptl. Biol. Med. (U.S.S.R.) (English Translation), 52: 1147-50(May 1962).

A study was made of the sorptive properties of albino rat tissues with respect to neutral red dye at various time intervals after exposure to doses of 400 and 800 r γ radiation. A regular increase in the staining of tissues from kidney, small intestine, spleen, and lung was observed. The application of a secretion from the skin gland of toads after irradiation prevented changes in the sorptive properties of tissues in irradiated animals. (C.H.)

20158 CYTOLOGIC ANOMALIES OF UTERINE ENDOMETRIUM FOLLOWING RADIUM THERAPY FOR SQUAMOUS CARCINOMA OF THE UTERINE CERVIX. P. Isador. Bull. soc. roy. belge gynecol. et obstet., 31: 389-93 (1961).

Histologic studies of uterine endometrium in 8 women after implantation of 63-76 mc for treatment of cervical cancer are reported. The endometrium showed atrophy, with a height of <1-2 mm. The epithelial cells were enlarged but the interstitial tissue was dense and fibrotic. The epithelial nuclei were in a prepyknotic state, and polyploidy was evident. It was concluded that the initial inflammatory reaction and these sequelae were attributable to ionizing radiation. This pseudoneoplastic histopathologic picture may be simulated by degenerative-regenerative states in endometrium under the effects of steroid hormones. (H.H.D.)

20159 REPERCUSSION OF THE EFFECT OF γ RAYS ON DESCENDANTS OF SITOPHILUS SASAKII TAKASHASHI (COLEOPT. CURCUL.). Paul Nardon (Laboratoire de Biologie, I.N.S.A., Lyon). Compt. rend., 254: 2454-6 (Mar. 26, 1962). (In French)

The irradiation of parents has the results of decreasing the fertility and weight of the descendants and of increasing their period of development. These effects are transmitted from one generation to the other without any need of resorting to selection. Whereas the first two tend to disappear, the increase of the period of development is stable for at least ten generations. (tr-auth)

20160 FETAL PRODUCTION AND LOCALIZATION OF CELLS ENDOWED WITH RESTORATIVE CELLS IN IRRADIATED MICE. N. S. Wolf and J. F. Duplan (Laboratoire Pasteur de l'Institute du Radium, Paris). Compt. rend. soc. biol., 155: 1895-7(1961). (In French)

In 18-day mice fetuses, the liver, spleen, and bone marrow produce cells capable of restoring the hematopoietic function after being irradiated with a 100% lethal dose of x rays. If, during this period of organogenesis, these organs are not the only sources of restorative cells, at least they are the principal ones. At the age of 14 and 15 days, the fetus does not possess bone marrow; at this stage the restorative capacities of cells other than those of the liver or spleen are negligible. (tr-auth)

20161 INVESTIGATIONS ON GRANULOCYTE PEROXYDASES AFTER IRRADIATION AND IN LEUKEMIAS. D. Raskovic (Université, Liège and Institut Boris Kidric à Belgrad). Compt. rend. Soc. biol., 155: 2049-50(1961). (In French)

The granulocyte peroxydases seem to undergo no modification of activity after sublethal irradiation of animals. It is the same in leukocytosis. This activity increases in myeloidal leukemias, in particular basophilic leukemia. However, it is in the granulocytes of the blood of lymphoid leukemia that it is most intense. (tr-auth)

20162 SEROTONIN AND THE LOCAL EFFECT OF X RAYS. 2. SEROTONIN AND THE EFFECTS OF X RAYS ON MITOSES IN THE HAIR FOLLICLE AND RADIOLOGIC ACANTHOSIS. A. Maggiora (Université, Geneva). Dermatologica, 124: 183-8(1962). (In French)

Injection of serotonin intraperitoneally in guinea pigs 5 min before irradiation with 800 r significantly inhibits the estrogen-stimulated mitosis in the nipples of male animals. Application of 800 r to the flanks of guinea pigs evokes a transient epilation that can be completely prevented by 5-min prior intraperitoneal injection of 15 mg serotonin creatinine sulfate. With 1600 r doses, transient epilation occurs if serotonin is given before irradiation, but if given after irradiation, loss of hair persists. Histologic study of these reactions in skin shows that when serotonin is given before, but not after, 1600-r irradiation, hair bulbs are protected from destruction and mitoses appear after irradiation. Serotonin also inhibited the marked acanthosis developing after irradiation. However, if it is given after irradiation, hair follicles are lost, nuclei become pyknotic, and acanthosis occurs as in irradiated controls. (H.H.D.)

20163 EXPERIMENTAL ECZEMA. 16. DIMINUTION OF THE ECZEMATOUS REACTION IN PREIRRADIATED GUINEA PIGS. A. Maggiora and H. Lozeron (Université, Geneva). Dermatologica, 124: 240-4(1962). (In French)

Irradiation of small areas of guinea pig skin with 1600 r produced persistent alopecia and acanthosis, without any other subsequent histologic or macroscopic changes in skin. Forty days after such local irradiation of skin, the animals were sensitized to chlorodinitrobenzene and skin reactions were tested with the same compound 7 days later on both the irradiated and control areas. In contrast to the intense eczema developing in control skin, irradiated skin showed a complete lack of reactivity to the allergen. It was shown that the absence of reactivity in irradiated skin was not the result of the existing acanthosis, since acanthosis induced by applications of erucic acid did not block the eczematous response to the allergen. Nor was the lack of reactivity due to the absence of hair, since radiation-induced inhibition of eczema could be demonstrated in skin normally lacking hair (nipples). (H.H.D.)

20164 A PHENOMENON OF COMPETITION BETWEEN THE ANLAGE OF TIBIA AND FIBULA IN THE CHICK EMBRYO DEMONSTRATED BY X IRRADIATION. Etienne Wolff and Madeleine Kieny. Develop. Biol., 4: 197-213 (Apr. 1962). (In French)

Leg buds of chick embryos at Hamburger-Hamilton stages of 18-21 were irradiated by total homogeneous radiation, selective radiation applied to the anlage of tibia or fibula, or total heterogeneous radiation. Total homogeneous radiation showed the respective potencies of the anlagen of tibia and fibula and revealed competition between them, as seen by normal differentiation of tibia and deficient development or absence of fibula. Selective irradiation of either anlage suppressed the competitive effect; the protected anlage developed normally. Selective irradiation of fibula anlage prevented its development but irradiation of tibia merely reduced tibial length. Total heterogeneous irradiation of leg bud restored the competition when the tibia received 3 times more radiation than fibula anlage, although the dosage received by fibula anlage was not sufficient to prevent fibula development. The results indicate that in radiation-damaged leg bud, surviving embryonic material is preferentially utilized for tibial development at the expense of fibular development. (H.H.D.)

20165 PROVOCATION OF A RADIATION CATARACT BY TRAUMATIZING AN IRRADIATED EYE LENS. V. V. Popov. Doklady Akad. Nauk S.S.S.R., 143: 441-3(May. 11, 1962). (In Russian)

Young frogs (Rana temporaria) and white mice were subjected to x-ray doses varying from 350 to 2000 r. An incision was made in the right eye to a depth of one-half of the diameter of the lens. The left eye was the control. With a dose of 1000 r, clouding of the lens was noted in 3 to 4 days after the operation, and formation of a milky mass was observed in two weeks. With 2000 r, total clouding of the lens was observed in one to two days after the operation. With a dose of 350 r, spots began to appear 14 to 16 days after the operation. The lens was completely clouded in 18 days. The left eye remained completely normal for 20 days after the incision in all the experiments. With the control, unirradiated animals, a temporary cloudiness was noted near the incision, but this cloudiness vanished rapidly. These experiments indicate that there is some risk to man from an eye operation, if the person has previously been exposed to a relatively high level of ionizing radiation. The accumulation of many small doses may also be harmful. (TTT)

20166 A BIOCHEMICAL ANALYSIS OF THE REACTION OF MUSCLE TISSUE TO RADIATION DAMAGE UNDER CONDITIONS OF MECHANICAL TRAUMA. M. F. Popova (Severtsov Inst. of Animal Morphology, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R., 143: 444-7(Mar. 11, 1962). (In Russian)

One of the hind extremities of the white rat was subjected to an x-ray dose of 2000 r with a 5 mm lead protective shield being used to cover the rest of the body. On the day after irradiation, a transverse cut was made in the calf muscle, or else a graft of granulated irradiated calf muscle was performed. No operation was carried out on the control group. The rats were killed on the 1st, 2nd, and 3rd days after the operation. The use of transplanted, granulated tissue hastened the recovery process. The content of ribonucleic acid (RNA) was 260% above normal. The RNA content was found to attain 200% above normal for the rats with a transverse cut on the calf. If the transverse cut is made after irradiation, the recuperative process is slowed down significantly. The recuperative processes begin earlier and proceed more intensively with the use of transplanted, granulated muscle tissue than they do when a transverse cut is made on the calf muscle. (TTT)

20167 THE CORRELATION BETWEEN GERMINATION AND SURVIVAL IN DIFFERENT SPECIES OF CULTIVATED PLANTS AFTER IRRADIATION OF THE SEED WITH VARIOUS DOSES OF Co^{60} γ-RAYS. E. I. Preobrazhenskaya and N. V. Timofeev-Resovskii (Inst. of Biology, Ural Branch of the Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R., 143: 448-51(Mar. 11, 1962). (In Russian)

Although air-dried seed can be irradiated with a dose of a million roentgens and can be germinated on planting, much lower doses are required for survival of the seedlings. Irradiation of various plant seeds show that the plants can be divided into three groups. In the radiosensitive group the tolerance for germination is 500,000 to 1,000,000 r and for survival the tolerance is 15,000 to 25,000 r. In the average radiosensitive group the tolerances are 1,500,000 r for germination, and 50,000 to

100,000 r for survival. In the radioresistant group the tolerances are 2,000,000 to 3,500,000 r for germination, and 200,000 to 300,000 r for survival. The grasses can be classified as stable to radiation with respect to germination, but are sensitive to radiation with respect to survival. In general, other types of seeds can be placed in one of the classifications outlined above. (TTT)

20168 THE EFFECT OF A SINGLE GAMMA DOSE ON THE FREQUENCY OF OCCURRENCE OF OVARIAN TUMORS IN MICE. R. V. Smirnov (Central Research Inst. of Medical Radiology, USSR). Doklady Akad. Nauk S.S.S.R., 143: 1211-14(Apr. 11, 1962). (In Russian)

White mice were given single, whole-body doses of 100, 200, 400, 600, and 800 r of Co^{60} gamma radiation. After the natural death of the irradiated mice, cytological studies were made on various organs of the mice. The tumors formed as a result of radiation were classified as tubular adenomas, granular, luteal, nodular, and complex. The irradiated mice had 203 tumors as compared to 7 tumors in the control group. The frequency of tumor occurrence increased from 33.8% at a dose of 100 r to a maximum of 46.5% at a dose of 200 r, and then fell off gradually. The luteal and granular tumors predominated at a dose of 100 r, while the tubular adenomas were at a maximum at a dose of 200 r. Signs of increased hormonal activity were lacking in mice with tubular adenomas, while the mice with the other types of tumors showed signs of increased hormonal activity. (TTT)

20169 A POSSIBLE CONNECTION BETWEEN RADIATION RESISTANCE AND THE PHYLOGENETIC SYSTEM IN CULTIVATED PLANTS. E. I. Preobrazhenskaya and N. V. Timofeev-Resovskii (Biological Inst. of the Ural Affiliate of the Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R., 143: 1219-21(Apr. 11, 1962). (In Russian)

It has been found that plants can be arranged in three groups according to their resistance to ionizing radiation. Thus, the lethal dose is 15 to 25 kr for the sensitive group, 50 to 100 kr for the moderately sensitive group, and 200 to 300 kr for the resistant group. Varieties containing large seeds (legumes) are sensitive to radiation. All varieties containing a high content of oil in the seed are stable to irradiation (with the exception of perilla). However, there is no direct relationship between radiation resistance and the percentage of fat content in the seed. In addition, members of the mustard family are radiation resistant, even though only a small percentage have oil in the seed. A phylogenetic explanation of radiation resistance seems to be more satisfactory. Thus, members of the family Gnetaceae are the most radiation resistant, while the single-lobed plants (the grasses) belong to the sensitive group (12 varieties) and to the moderately sensitive group (5 varieties). The double-lobed plants show 27 radiation resistant varieties, 21 moderately sensitive, and only 4 that are sensitive. The radiosensitive varieties are primarily ephedra or single-lobed plants, while the radioresistant varieties are predominantly double-lobed plants. (TTT)

20170 MAMMARY HYPOPLASIA AFTER X IRRADIATION OF HEMANGIOMA IN INFANCY. A. Gregl and J. W. Weiss (Universitäts, Göttingen, Ger.). Fortschr. Gebiete Röntgenstrahlen u. Nuklearmed., 96: 272-7(Feb. 1962). (In German)

Five observations at the Göttingen University Clinic show that only direct irradiation of the mammary gland during infancy and early childhood leads to growth inhibition of the breast. The severity of the damage depends on the dose administered. (tr-auth)

20171 SARCOMA OF THE FRONTAL BONE AFTER X-RAY THERAPY. S. Wende (Universität, Berlin). Fortschr. Gebiete Röntgenstrahlen u. Nuklearmed., 96: 278-82(Feb. 1962). (In German)

A radiation-induced sarcoma of the frontal bone (histologically a spindle cell sarcoma) together with radiation necrosis occurring nineteen years following radiation therapy of a presumed cerebral tumor is described. There is a short discussion of the relevant problems. (auth)

20172 LIMB ANOMALIES AS RADIATION DAMAGE. J. Kolář (Charles Univ., Prague). Fortschr. Gebiete Röntgenstrahlen u. Nuklearmed., 96: 283-7(Feb. 1962). (In German)

The results of the observation of a 5-year old child whose parents were exposed to radiation are reported. The child was born with pathological changes of the skeleton, particularly of extremities, and with a mental deficiency. The possibility of radiation injury is discussed. (tr-auth)

20173 ON ACTIVATION OF THE SYMPATHICO-ADRENALIN SYSTEMS OF RATS AFTER X-IRRADIATION. H. Braun and H. J. Kuschke (Medizinischen Universitätsklinik, Würzburg, Ger.). Fortschr. Gebiete Röntgenstrahlen u. Nuklearmed., 96: 683-4(May 1962). (In German)

Irradiation of the head and neck of rats with 900 r did not lead to an increase in the urinary excretion of noradrenalin or adrenalin. This was contrary to previous findings of increased catecholamine excretion following total-body irradiation. (auth)

20174 ON THE PROBLEM OF THE EARLY DETECTION OF CLINICAL RADIATION RESISTANCE IN CERVICAL CARCINOMA AND THE ENSUING RESULTS THEREOF (DATA FROM THE END OF THE YEAR 1948 TO THE BEGINNING OF 1952). Julius Weishaar and Helga Demleitner (Universität, Erlangen, Ger.). Geburtsh. u. Frauenheilk., 22: 360-72(Apr. 1962)

In 448 patients with cervical cancer of grade I, II, or III, the effect of radiation therapy on the tumors 8 to 12 weeks later was studied in relation to the late (5-yr) cure rate. The treatment consisted by Ra implantation (total doses of 6000-7000 mg-hr) followed by roentgen radiation (8600-9800 r). An early effect on the tumor was found in 77% of the patients, while in 23% radiation resistance was noted. Tumor radioresistance showed no relation to the age of the patient, but was considerably more frequent in patients with initially poor clinical conditions. No relation was found between radioresistance and the histologically determined degree of maturity of the tumor cells. The percentage of radioresistant tumors according to degree of malignancy was 5% grade I, 14% grade II, and 29% grade III. The late cure rate showed no correlation with the early findings. (H.H.D.)

20175 THE FREQUENCY OF XO MALES AND INDUCED AUTOSOMAL CROSSOVERS AFTER IRRADIATION OF DROSOPHILA MELANOGASTER MALES IN AIR OR COMMERCIAL NITROGEN. Ruth Saevhagen (Univ. of Stockholm). Hereditas, 47: 23-42(1961). (In English)

Results are reported from an investigation of the frequency of induced XO males and induced autosomal crossovers in meiotic and premeiotic stages in Drosophila after irradiation of 0 to 1-day-old males. The effect of irradiation under anoxia upon the yield of XO males and upon the rate of induced autosomal crossovers was also studied during the period of highest sensitivity to x-ray irradiation. By use of a dual-purpose stock it was possible to study both aberrations in the same stock. It is shown that there is a significantly lower rate of induced XO males in experiments performed under anaerobic conditions compared to those irradiated in air. It is furthermore obvious that the difference is most drastic in mating periods corresponding

to the highest sensitivity. In order further to study the effect of irradiation under anaerobic conditions two experiments were performed where the dose was divided into two parts. The first part consisted of 1100 r in commercial nitrogen with an interval of 15 and 60 minutes, respectively, in air, whereupon the second part, 700 r in air, was given. The results indicate that there is some recovery after irradiation of the sensitive stages but that it could be only partly blocked by 700 r given in air within 15 minutes. That the reduced effect of irradiation under anoxia is not limited to XO males is obvious from the crossing-over study. The observed crossover data fit well with the sensitivity pattern obtained through XO studies. Furthermore it is evident that spermatozoa available for insemination on the 12th day and onwards chiefly might correspond to cells treated as spermatogonia. (auth)

20176 THE RELATION BETWEEN X-RAY SENSITIVITY AND STAGES OF DEVELOPMENT OF TREATED CELLS IN SPERMATO- AND SPERMIOGENESIS OF DROSOPHILA MELANOGASTER. Ruth Saevhagen (Univ. of Stockholm). Hereditas, 47: 43-68(1961). (In English)

By using a dual-purpose stock it was possible to study the frequency of induced XO males and induced non-disjunction between the paternal X and Y chromosomes in Drosophila after 0 to 1 and 3 to 4 day old y^{36}; $sc^{8}Y$ males were irradiated (1100 r) and mated to virgin y w sn females in successive mating periods. The first mating period was delimited to 0 to 4 hours after irradiation but from the 4th day and on each mating period consisted of 24 hours. It is shown that irradiation of Drosophila males causes non-disjunction between the paternal X and Y chromosomes. Hence, the occurrence of an increase in the frequency of non-disjunction in sperm ejaculated during a limited period after irradiation must be taken as an indication that those spermatozoa were in meiosis at the time of treatment. Factors which may influence this cell stage/sensitivity relationship are discussed. (auth)

20177 INDUCTION OF SOMATIC CHANGES IN SOLANUM TUBEROSUM BY ACUTE GAMMA IRRADIATION. Aage Heiken (Inst. for Plant Research and Cold Storage, Hynashamn, Sweden). Hereditas, 47: 606-14(1961). (In English)

The mutagenic somatic effects of acute γ radiation on the potato was studied. In the first vegetative generation, there was a clear suppressing effect of radiation increasing from the lowest to the highest doses (250 to 8,000 r). The threshold value, giving about 50% lethality, was found to be 8,000 r. However, on the basis of previous x-ray experiments, this value was regarded as an upper limit only reached under favorable conditions. In the second vegetative generation, seven somatic aberrations were isolated. In relation to the total number of surviving families, they amounted to 6.7%. The permanence of the types induced was proven during three years propagation. Due to the fact that changes in the morphology of the potato may be caused by virus infection, it was found necessary to check all the types induced. Of the tests for the presence of viruses, that of transmission by grafting was considered the most conclusive. However, none of the aberrant forms isolated transmitted their characteristic features. The experimental results are discussed from a breeding point of view. (auth)

20178 MUTATIONS INDUCED BY X-RADIATION IN SWEET POTATOES. A SECOND REPORT. Ching-san Liao and Hwai-pin Cheng (Taiwan Agricultural Station, China). Ho Tsu K'o Hsueh, 2: No. 4, 55-9(1960). (In Chinese)

The experiments initiated in May 1958 on the induced mutations in sweet potatoes by x-rays were continued. The findings were (1) the critical limit for normal germination after irradiation was 10,000 r and that germination completely stopped if the strength was above 30,000 r. The optimum strength to induce mutations was 5000 r. (2) Induced characteristics show segregation in the r_1 generation. (TTT)

20179 MUTATION IN RICE INDUCED BY X-RADIATION. Chen-ying Wang (National Taiwan Coll. of Agriculture, Japan). Ho Tsu K'o Hsueh, 2: No. 4, 60-6(1960). (In Chinese)

Several varieties of rice were irradiated with x-rays as dry seeds, soaked seeds, and young plants. Sterile plants were produced. Seeds taken from sterile plants segregated into fertile and sterile strains in the X_2, X_3 and X_4 generations. The induced strains were grouped into five segregation tyoes A, B, C, D, and E according to their mode of segregation. The pollen mother cells of the sterile strains were examined at the meiotic division, a large number of them were found to have quadrivalent and univalent chromosomes. The shape of the quadrivalent chromosomes is predominantly that of a ring though other shapes also occur. Reciprocal translocation of chromosomes at meiotic division was the cause of the quadri- and univalent chromosomes. Morphological and physiological changes were observed in the mutated strains but the characteristics were recessive. (TTT)

20180 THE USE OF X-RAY AND THERMAL NEUTRONS IN PRODUCING HERITABLE CHANGES OF RICE. Cheng-hwa Huang (Taiwan Provincial Coll. of Agriculture, Japan). Ho Tsu K'o Hsueh, 3: No. 1, 25-37(1961). (In English)

Five varieties of Ponlai rice seeds were irradiated in 1957 at the Brookhaven National Laboratory. Seed samples of 200 grams of each variety were exposed to x rays, one batch at 20 Kr and one at 25 Kr, and thermal neutrons, one batch for 15 hrs and another for 20 hrs (flux × time was 3.60×10^{13} and 4.90×10^{13}). The seeds were grown and the plants and their yields were compared with control plots of untreated seeds. Inhibition of seedling growth was more pronounced in seeds exposed to thermal neutrons. Heading dates, in general were delayed. In the R_2 generation 0.09 per cent of the plants showed early maturity mutation. In the R_2 generation albino plants (deficiency of chlorophyll) were observed. None survived for transplanting. Other mutations as awned, hull color, narrow or broad leaf, growth habit, and pleotropic change of morphological character were also observed. The rate of mutation varied with the type and amount of radiation. Sterility was pronounced in the R_2 generation, more than 8% showed partial sterility and 0.5% were totally sterile. Cytological studies both in R_1 and R_2 generations using acetocarmine smear preparations indicated that the frequency of aberration was closely associated with sterility in R_1 generation. Most chromosome aberrations were tetravalents formed in chain, ring, or other shapes. A few chromosomal bridges were also found in R_1 generation. The frequency of aberration increased with rate of treatment and also varied with the varieties. All early maturing and other beneficial mutations in R_2 generation were selected and grown as plant progeny rows in R_3 generation. Most of them bred true and were harvested for yield and disease resistance tests in the R_4 generation. (TTT)

20181 PATHOLOGICAL EFFECTS OF IONIZING RADIATIONS. V. R. Khanolkar (Bombay Univ. and Indian Cancer Research Centre, Bombay). Indian J. Radiol., 14: I-XIII(May 1960).

A comprehensive general review is presented of recent

data on the biological effects of radiation on man. Hazards due to the increasing use of x rays and radioisotopes for medical, industrial, and agricultural uses are discussed in detail. (C.H.)

20182 THE EFFECT OF IRRADIATION ON THE SHRINKAGE TEMPERATURE OF COLLAGEN. A. J. Bailey, J. R. Bendall, and D. N. Rhodes (Low Temperature Research Station, Cambridge, Eng.). Intern. J. Appl. Radiation and Isotopes, 13: 131-6(Mar. 1962). (In English)

Collagen fibers of rat-tail tendon were exposed in saline at 0°C to doses of ionizing radiation up to 40 Mrad. The hydrothermal shrinkage temperature was found to decrease progressively with dose; after 5 Mrad from 61 to 47°C, after 20 Mrad to 33°C and after 40 Mrad to 27°C. At the same time the amount by which the fibers shortened under a fixed load increased from 6% for the native material to a maximum of 70% after doses greater than 6 Mrad. Variation of irradiation conditions indicated that these effects were due to the direct action of the radiation upon the protein molecule and not to subsequent chemical attack by radicals from the water. Possible chemical mechanisms of such action are discussed. (auth)

20183 RADIOMODIFICATION OF THE SEXUAL HORMONES OF THE RAT. I. EFFECTS ON TESTOSTERONE IN NORMAL RATS IRRADIATED WITH Co^{60}. R. Ghys (Université, Laval, Can.). J. belge radiol., 44: 641-65 (1961). (In French)

The protective effects of testosterone and estradiol injections in Co^{60}-irradiated "Wistar" and "Sprague-Dawley" rats are determined for sublethal to superlethal doses (up to 900 rad). The hematological effects and weight variations are studied in the rats up to about 40 days following the irradiation. The effects are found to differ for the male and female rats. (T.F.H.)

20184 A CASE OF LATE RADIONECROSIS AFTER ACCIDENTAL EXPOSURE TO X RAYS. A. Massart (EURATOM, Brussels) and J. Henry. J. belge radiol., 44: 667-70(1961). (In French)

The clinical picture of late radionecrosis by terminal arteritis appears after one year at a finger accidentally irradiated by a large dose of soft x rays. The immediate local lesions were those of classical acute radiodermitis. After a 6-week vasodilatatory treatment (Padutin) an apparent recovery of the lesions was obtained. (auth)

20185 RADIO-MODIFYING ACTION OF SEXUAL HORMONES IN THE RAT. II. EFFECT OF HORMONAL TREATMENT COMBINED WITH IRRADIATION IN THE HYPOPHYSECTOMIZED RAT. Roger Ghys (Université Laval, Can.). J. belge radiol., 45: 67-78(1962). (In French)

The effects of testosterone and of oestradiol injection before irradiation are, in Wistar rats, the same in hypophysectomized as in normal animals, both during the pre-irradiation period and afterwards. Oestradiol has an important sensitizing effect in these animals, testosterone has the same, though much less marked, effect. It may thus be concluded, that the effects observed after injection of high doses of sexual hormones before irradiation, are due to the direct hormonal action and not to a disturbed hypophyseal function. (auth)

20186 STUDY OF SOME RADIOPROTECTIVE PHENOMENA IN AN EMBRYONIC CHICK ORGAN CULTURED IN VITRO. J. M. Kirrmann (College de France, Nognet-sur-Marne). J. Embryol. Exptl. Morphol., 10: Pt. 1, 27-37(Mar. 1962). (In French)

The intestine and testis of 10-day chick embryos were cultured for 8 to 15 days and irradiated with 800 to 6400 r in the absence and presence of radioprotective compounds. Irradiation with 4800 r of control intestine within 24 hr caused a cessation or marked diminution of peristaltic activity, granulated areas and opaque, whitist spots, followed by cytolysis and necrosis. These changes were not modified by the radiation dose but their time of appearance changed with the dose. In contrast, testis never showed cytolysis or necrosis, even at the highest dose, but only a decrease in volume following irradiation. Cysteamine at a concentration of 1:800 retarded the appearance of necrosis by 2-4 days at moderate doses (4800 r) but did not inhibit it at high doses. Cysteamine was only weakly effective in testis and retarded necrosis only at the lowest dose (800 r). Methylene blue, in its leuko form at a concentration of 1:4000, was similarly protective in intestine but completely ineffective in testis cultures. Maintenance of the cultures in N_2 or H_2 10 hr before irradiation had a protective effect on intestine but not on testis. Conversely, cultures in an atmosphere of O_2 sensitized intestine to radiation. These protective and sensitizing effects were shown to be mainly manifested in the mucosal epithelium of intestine, the mesenchymal and muscle cells being less influenced by radiation or these agents. Its is suggested that the effects of these agents are manifested on cellular metabolic processes which are affected by ionizing radiation. (H.H.D.)

20187 RADIATION MALFORMATIONS BELONGING TO THE CYCLOPIA-ARRHINENCEPHALIA-OTECEPHALIA GROUP IN THE MOUSE FETUS. Ujihiro Marakami, Yoshiro Kameyana, Akio Majima, and Tsuneyoshi Sakurai (Nagoya Univ., Japan). J. Embryol. Exptl. Morphol., 10: Pt. 1, 64-72(Mar. 1962).

Pregnant mice on the 8.5th day of gestation were subjected to 200-r whole-body irradiation and the fetuses were examined on the 13th to 19th day of gestation. Incidence of fetal death (23.0%) was much higher than in the controls (8.2%), and malformations of the nose, eyes, and ears occurred in 32%. These malformations included alterations leading to a beaklike snout (19%), a univentricular telencephalon with cyclopia (6%), and forms transitional between these two (6%). These malformations were specific for irradiation on the 8.5th day of gestation; in previous studies they were not prominent when irradiation was carried out on the 8th, 10th, or 11th day. During this most sensitive developmental stage at 8.5 days, 3 to 5 brain vesicles are formed and the anterior neuropore is closed, which may account for the greater effect of teratogenic agents on the central nervous system at this time. Other abnormalities included exencephalia (2%), hydrocephalus (4%), microcephalia (0.7%), abnormally shaped head (5%), spinal cord anomalies (6%), eye anomalies (29%), harelip and cleft palate (12%), tail abnormalities (6%), and thoraco-abdominal hernia (5%). (H.H.D.)

20188 CLINICAL INVESTIGATION OF BLOOD PLASMA PROTEIN AND PROTEIN FRACTIONS IN PERSONS HAVING PROLONGED CONTACT WITH IONIZING RADIATION. O. I. Kudryashova (State Scientific-Research Inst. of Roentgen-Radiology, Dept. of Health, USSR). Med. Radiol., 7: No. 4, 54-7(Apr. 1962). (In Russian)

The content of blood plasma protein and protein fractions in persons protractedly working with ionizing radiation sources was investigated. It was found that the long-term effect of small doses of ionizing radiation causes biological reactions in the organism differing from those due to large doses. The changes in the protein metabolism are manifested by an augmented content of blood plasma at the expense of albumins, gamma-globulins, and fibrinogen. (auth)

20189 CHANGES OF PULMONARY BLOOD VESSELS IN CHRONIC RADIATION SICKNESS. I. S. Amosov (Kirov Order of Lenin Military-Medical Academy, USSR). Med. Radiol., 7: No. 4, 57-64(Apr. 1962). (In Russian)

Studies were made of changes occurring in blood vessels of the lungs during chronic radiation sickness. Angiocardiographic investigations were conducted on vessels of the lesser circulation in 105 rabbits, of which 15 served as control and 90 with chronic radiation sickness induced by daily whole-body exposure in doses of 25 r for a period of 2-3 months (total dose 1000 r). (auth)

20190 FEATURES PECULIAR TO THE ERYTHROPOIESIS IN IRRADIATED GRAVID ANIMALS. A. P. Kiryuschenkov and N. M. Pobedinskii (Sechenov Order of Lenin Inst. of Medicine, Moscow). Med. Radiol., 7: No. 4, 66-70 (Apr. 1962). (In Russian)

Peculiarities of erythropoiesis were studied in irradiated gravid rats by labeled iron (Fe^{59}). It was found that during pregnancy the accumulation of Fe^{59} in the blood is more intensive (experiments with non-irradiated rats). In irradiated gravid animals the activity of Fe^{59} in the blood decreases not as sharply as in the irradiated non-gravid animals. This testifies to the fact that functional inhibition of the bone marrow caused by radiation is not as pronounced in the gravid rats as in the non-gravid ones. Labeled iron passes through the placenta from the mother to the fetus. In the progeny of irradiated rats there was a lower content of Fe^{59} in the blood than in that of non-irradiated animals. (auth)

20191 FUNCTIONAL CHANGES OF THE ADRENAL MEDULLARY LAYER DURING THE ACTION OF LOW DOSES OF INTERNAL IRRADIATION ON THE ORGANISM. V. I. Kandror (Ersman Scientific-Research Inst., School of Radiology, Moscow). Med. Radiol., 7: No. 4, 71-5(Apr. 1962). (In Russian)

Studies were made of the reactions of the adrenal medullary layer (by the content of catecholamines therein) in rats during the introduction of 500, 50, and 5 μc per 250 g of body weight. It was demonstrated that the irradiation dose, caused by the decay of 500 μc of Na^{24}, calls forth an intensification of synthetic processes in the medullary apparatus. Fifty and 5 μc of Na^{24} also provoke the growth of the quantity of hormones of the medullary layer. No inhibition of the medullary function during the introduction of the above quantities of the isotope was observed. The indexes reverted to normal one week after irradiation. (auth)

20192 CONSUMPTION OF OXYGEN IN RATS DURING IRRADIATION. A. Vatsek (Inst. of Biophysics, Czechoslovak Academy of Sciences). Med. Radiol., 7: No. 4, 83-4 (Apr. 1962). (In Russian)

The influence of central and peripheral nervous systems on the intensity of x-ray induced metabolic processes was studied in 80 (20-g) rats exposed to a total dosage of 500 r at 50 r/min and in 50 (2800-g) rabbits exposed to a total dosage of 400 r at 40 r/min. The results confirmed an anticipated intensified metabolic process (with a reflex mechanism increased oxygen consumption). Exposure of the head revealed no direct participation of the central nervous system in intensified oxygen consumption. It is postulated that the vegetative nervous system stimulates the oxygen consumption in animals. (R.V.J.)

20193 IRRADIATION EFFECTS ON STRAND SEPARATION OF DEOXYRIBONUCLEIC ACID. H. M. Klouwen, A. W. M. Appelman, and G. W. Barendsen (Organization for Health Research T.N.O., Rijswijk, Netherlands). Nature, 194: 554-5(May 12, 1962).

The effects of u-v and x rays on the heat-induced strand separation and recombination on cooling in desoxyribonucleic acid (DNA) were investigated. DNA preparations were incubated at 89 or 95°C for 20 min and their optical densities at 260 mμ read off at two intervals during the cooling period; the effects of u-v irradiation before heating and between two heating periods were determined. It is concluded that u-v irradiation disturbs the process of strand separation and recombination and that the effects are partially reversible by another heating. No definite effects of x-ray doses of 50 to 10,000 r were observed. Several possible explanations for the observed effects are given. (D.L.C.)

20194 CHANGES IN METABOLIC ACTIVITIES OF HEPATOMA CELLS FOLLOWING INCREASING X-RAY DOSES. Piero Cammarano (Instituto di Patologia Generale, C.N.R.N., Milan). Nature, 194: 591-2(May 12, 1962).

Studies were made on the effects of increasing doses of in vitro x irradiation up to 100 kr on respiration, glycolysis, and incorporation of labeled leucine into protein of Yoshida ascites hepatoma cells. The results show that x irradiation does not affect respiration and aerobic incorporation of leucine but impairs progressively anaerobic glycolysis and anaerobic incorporation of leucine. (D.L.C.)

20195 ELECTRON SPIN RESONANCE IN γ-IRRADIATED DEOXYRIBONUCLEIC ACID. C. Dorlet, A. van de Vorst, and A. J. Bertinchamps (Université, Liège). Nature, 194: 767(May 26, 1962).

Electron spin resonance studies were made of DNA from trout sperm which was irradiated in air at 30°C with Co^{60} gamma radiation. The radiation yield G was 2×10^{-4}, and both the shape and intensity of the resonance line varied with time. After 4 hr post-irradiation, the central line was practically unchanged (line width 10 gauss), though the heights of the derivatives of the side lines decreased. After 24 hr, the central line width became 14 gauss and the side lines were smeared out. (D.L.C.)

20196 EXPERIMENTAL OXIDATION OF HAEMOGLOBIN EFFECTS OF IRRADIATION IN RATS. W. K. Metcalf (Univ. of Bristol, Eng.). Nature, 194: 783(May 26, 1962).

The effect of radiation on the stability of hemoglobin against oxidation by nitrites was studied in the rat, using 500 r of Co^{60} gamma radiation. The oxidation sensitivity increased at all ages after irradiation, although the initial change varied with age. Riboflavin was found to alter the increased oxidation sensitivity toward the normal when given in conjunction with adenosine triphosphate. (D.L.C.)

20197 X-RAY SENSITIVITY OF SPERMATOGONIA AND SPERMATOZOA IN DROSOPHILA MELANOGASTER. Karl H. Ytterborn (Univ. of Stockholm). Nature, 194: 797-8(May 26, 1962).

Experiments were conducted to determine if, after irradiation of young spermatogonia, other mutations behave in a manner similar to the induced crossing-over work of Slivhagen. A chromosome free from lethals was isolated and x-ray doses of 900 r used. Spermatogonia were irradiated in larvae, and after eclosion the males were mated in two periods for lethal tests. Spermatozoa in adult males were also irradiated for comparison. The rate of chromosomes with lethals is ~3 times higher for spermatozoa than for spermatogonia after irradiation. A higher rate of independently induced lethals and a lower rate of clusters were found in the mating period 0 to 3 days than in the period 15 to 18 days after eclosion, while there is no significant difference in the rates of chromosomes with lethals; the results agree well with those of Slivhagen.

Possible explanations of the results are discussed. (D.L.C.)

20198 CROSS-LINKING OF DEOXYRIBONUCLEIC ACID TO PROTEIN FOLLOWING ULTRA-VIOLET IRRADIATION OF DIFFERENT CELLS. P. Alexander (Royal Cancer Hospital, London) and H. Moroson. Nature, 194: 882-3(June 2, 1962).

Ultraviolet radiation effects on DNA when irradiated as a nucleo-protein inside cells were found to be qualitatively and quantitatively different from those that are produced when pure DNA is treated. The test used for the detection of crosslinks between DNA helices was the formation of an insoluble gel network. When the DNA was isolated from sperm cells by standard deproteinization procedures, the amount recovered decreased markedly on irradiation. Some of the DNA from the irradiated cells was found in the insoluble protein fraction, instead of in the supernatant. This is assumed to be due to the fact that protein became covalently linked to the DNA and that this complex travels with the protein fraction during the separation procedure. It is suggested that protein linking to DNA may contribute significantly to the killing of cells by ultraviolet light, since the reaction is readily detectable by physico-chemical methods with amounts of radiation that are necessary for killing 99.9% of the cells, and smaller doses are therefore likely to alter biologically significant amounts of DNA. (P.C.H.)

20199 ALTERATIONS IN DEOXYRIBONUCLEIC ACID FROM REGENERATING RAT LIVER AFTER X-RADIATION IN VIVO. R. Foster and Margery G. Ord (Univ. of Oxford). Nature, 194: 883-4(June 2, 1962).

Male, hepatectomized rats were given 100 μc P^{32}/100 g body weight immediately following exposure to 2000 r whole-body irradiation and killed 30 min later. Control animals were treated similarly except for the absence of irradiation. DNA from control and irradiated rats was prepared simultaneously. Preliminary experiments established that identical samples of DNA showed less than 3% difference in ultraviolet and P^{32} elution patterns in the second and third peaks of specific activities and less than 6% difference in the fourth peak. X radiation produced no change in the ultraviolet absorption characteristics of the unfractionated material, although incorporation of P^{32} was reduced to 40 to 50% of the control level. The difference in behavior of different peaks after exposure and the lack of change in H bonding suggest that the altered fractionation pattern is not due to DNase action. The changes observed provide additional evidence for alterations in DNA structure after x radiation in vivo. (P.C.H.)

20200 RAY CATARACT IN THE LENS OF THE EYE CAUSED BY WOUNDING AFTER X-IRRADIATION. V. V. Popov (Moscow State Univ.). Nature, 194: 884-5(June 2, 1962).

The heads of adult frogs and white mice were irradiated and after 2 days the x rayed lenses were cut to a depth of half their diameter. The right eye of the irradiated animal was operated on, while the left one served as control. The frogs received 1000, 18 to 2000, and 11 to 4000 r and the mice received 350, and 11 to 800 r. The development of the cataract proceeded so violently, in frogs particularly, that it was impossible to follow the usual stages of its formation. In frogs the lens began to swell at once, which did not allow it to become separated from that of a ripe and often even an over-ripe cataract. The most characteristic stages in changes in the lens of the frogs and mice are illustrated. (P.C.H.)

20201 EFFECT OF IRRADIATION ON POLIOVIRUS YIELD OF CULTURED KIDNEY CELLS OF THE RHESUS MONKEY. Seymour Levine (American Cyanamid Co., Pearl River, N. Y.). Nature, 194: 895-6(June 2, 1962).

Experiments on the rhesus monkey which demonstrated that irradiated monkey kidney cells which consistently form giants also yield more poliovirus per cell are described. Giant cells were obtained consistently when cell suspensions were prepared from monolayers of primary monkey kidney and were irradiated at the time of plating. In all cases the irradiated cells yielded more virus. A microscopic examination was made of the size of both irradiated and nonirradiated cells 6 and 7 days after plating. It is concluded that the correlation between the development of large cells and an increase in virus yield, which was previously observed in non-irradiated cells, applies also to irradiated cells. (P.C.H.)

20202 IMMUNIZING EFFECT OF IRRADIATED CERCARIAE OF SCHISTOSOMA MANSONI IN RHESUS MONKEYS. S. R. Smithers (National Inst. for Medical Research, London). Nature, 194: 1146-7(June 23, 1962).

Hamsters were used for estimating the dose of x irradiation which was necessary to prevent cercariae of S. mansoni from developing to maturity but which still allowed them to migrate through the lungs and reach the liver. An x-ray dose of 3000 r prevented any cercariae from surviving for > 6 weeks in hamsters; 2000 r prevented all but 1% of the worms from surviving beyond this time. Attempts to protect rhesus monkeys against subsequent challenge with S. mansoni were made by exposing them to cercariae irradiated at 2000 and 3000 r. The protection was found to be incomplete. (D.L.C.)

20203 PURE MUTANT CLONES INDUCED BY ULTRAVIOLET LIGHT IN THE GREEN ALGA, CHLAMYDOMONAS REINHARDI. Nicholas W. Gillham and R. P. Levine (Harvard Univ., Cambridge, Mass.). Nature, 194: 1165-6 (June 23, 1962).

Cells of C. reinhardi were irradiated with uv light, plated immediately after irradiation, and the colonies on a portion of the plates broken up (spread) to determine whether mixed mutations were induced. The mutational system used was one using forward mutations to acetate dependence. The number of mutants recovered in the spread and unspread series was about the same, indicating that the majority of uv-induced mutations to acetate dependence in C. reinhardi arise only in pure clones and that uv light induces mutations by a mechanism directly affecting the parental DNA. (D.L.C.)

20204 ROLE OF THE MEDIUM IN RADIATION EFFECTS ON CELLS CULTIVATED IN VITRO. Ch. M. A. Kuyper and L. A. Smets (R. C. University, Nijmegen, Netherlands). Naturwissenschaften, 49: 21-2(1962). (In English)

Ionizing radiations suppress the onset of mitosis and affect the synthesis of DNA in cells cultivated in vitro. In order to determine if the culture had any effect on the onset of mitosis and DNA metabolism, a medium containing inorganic salts, lactalbumine hydrolysate, and 5% calf serum was irradiated with a dose of 500 r. Immediately after irradiation, the medium was added to HeLa cells extracted from embryonic calf liver. The inhibitory effect of the irradiated medium on the mitotic index is quite clear. The uptake of H^3-thymidine by the nuclei was also strongly inhibited by the irradiated medium. (J.S.R.)

20205 RETRACTION ACCELERATION AFTER X IRRADIATION. G. Brilla and E. Kuhnke (Universität, Bonn). Naturwissenschaften, 49: 61-2(1962). (In German)

The irradiation of thrombocyte-free plasma, to which shortly before coagulation the previously removed thrombocytes had been added, leads to an acceleration of the re-

traction (the reduction and compression of the blood clot) both in velocity and dimensions. It was concluded that the origin of the retraction is a lateral juxtaposition of the fibrin fibrilla. The cause for the modification of the fibrinogens is discussed. (J.S.R.)

20206 IN VITRO INVESTIGATIONS ON THE EFFECT OF IONIZING RADIATION ON CELLULOSE DECOMPOSITION IN THE BOVINE RUMEN. Johannes Brueggemann and Dieter Giesecke (Universität, Munich). Naturwissenschaften, 49: 62(1962). (In German)

Ox rumen bacteria, incubated in artificial rumen, were exposed to various doses of x radiation, and the number of surviving bacteria, the cellulose decomposition, and the formation of volatile fatty acids were determined as a function of radiation dose. The results show that cell inactivation and depression of fermentation capacity is preceded by a stimulation, which reaches a maximum at 0.5 to 1 kr. After irradiation with more than 2 kr, these values fall rapidly. (J.S.R.)

20207 FREQUENCY OF LEAF COLOR MUTATIONS AFTER X IRRADIATION OF VARIOUS ONTOGENETIC STAGES OF KALANCHOE. B. Schwemmle and G. Roebbelen (Universität, Göttingen, Ger.). Naturwissenschaften, 49: 64-5(1962). (In German)

In a study of radioinduced mutations in Kalanchoe blossfeldiana, presoaked seeds, mature pollen, and fertilized ova were irradiated with sublethal doses. The mutations found in the X_2 generation were tabulated. (J.S.R.)

20208 COMPARATIVE EFFECT BETWEEN ETHYL METHANE SULFONATE AND X RADIATION IN MUTATION RESEARCH WITH ARABIDOPSIS THALIANA. Gerhard Roebbelen (Universität, Göttingen, Ger.). Naturwissenschaften, 49: 65(1962). (In German)

A comparative study was made of the mutagenic effects of x radiation and ethyl methane sulfonate (EMS). The EMS was used to treat both seeds and buds. The number of mutations in the M_2 generation were determined and the results were tabulated. EMS treatment of seeds gives the highest mutation rate. Possible reasons for the changes in the mutation spectrum are given. (J.S.R.)

20209 INFLUENCES OF X-RAY IRRADIATION ON THE URINARY EXCRETION OF CORTICOSTEROID IN RABBITS. Teh-jen Shieh (National Taiwan Univ.). Ôsaka Shiritsu Daigaku Igaku Zasshi, 10: Suppl. No. 1, 329-36 (Jan. 1961). (In Japanese)

Whole-body x irradiation of rabbits at doses of 300 to 600 r resulted in an increase in the urinary excretion of 17-ketosteroids and blood sugar, followed by a decrease in both responses. The responses following irradiation of a hypophyseal area were similar to those following whole-body exposure but irradiation of the thyroid area produced less marked effects. (C.H.)

20210 CONGENITAL MALFORMATIONS; THE ROLE OF EXOGENOUS FACTORS. A. Giroud and H. Tuchmann-Duplessis (Faculte de Medecine, Paris). Pathol. et Biol. Semaine Hop., 10: 119-51(Jan. 1962).

A review of the teratogenic effects of ionizing radiation and other physical and chemical factors is presented with 400 references. (H.H.D.)

20211 EXPOSURE OF MAN TO IONIZING RADIATION ARISING FROM MEDICAL PROCEDURES WITH SPECIAL REFERENCE TO RADIATION INDUCED DISEASES. AN ENQUIRY INTO METHODS OF EVALUATION. A REPORT OF THE INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION AND INTERNATIONAL COMMISSION ON RADIOLOGICAL UNITS AND MEASUREMENTS. Phys. in Med. Biol., 6: 199-258(Oct. 1961).

The International Commission on Radiological Protection and the International Commission on Radiological Units and Measurements carried out a study on the exposure of man to ionizing radiation arising from medical procedures. Emphasis was placed on radiation-induced diseases. The annual numbers of x-ray examinations per capita were examined for 13 countries and for 4 cities. The examinations were sub-divided by sex and age. Data are tabulated on radiation dose ranges for various tissues of interest as far as these data are available. Problems encountered in epidemiological studies of possible radiation-induced disease are discussed. Biological and physical parameters are outlined and examples of the use of various biological and physical parameters are included. Data are tabulated on radiation dose from diagnostic radiology, radiotherapy, unsealed radionuclides, and on the mass and distribution of active bone marrow in the skeleton, and the effects of radiation on life expectancy. (C.H.)

20212 DIFFERENT EFFECTS OF RADIATIONS OF DIFFERENT ENERGY ON VEGETABLE MITOSIS. Caprotti Marco and Pisani Angelo (Università, Pavia, Italy). Radiobiol. Latina, 4: 91-7(Apr.-June 1961). (In Italian)

The frequency of mitosis and the percentage of mitotic abnormalities were studied in Vicia faba-tips treated with equivalent doses of radiations of different Let. Differences in the mitotic index are small, hardly greater than possible errors in dosimetry. Differences in the percentage of mitoses affected by radiation are more significant; the relatively high incidence of late anomalies is very characteristic of all the kinds of radiation used. (auth)

20213 MODIFICATIONS OF THE DIFFUSION OF LIQUIDS AND OF REACTIVITY IN THE SKIN OF ANIMALS IRRADIATED DURING HIBERNATION. G. R. Bandirali, F. A. Paolini, and A. Cavina Pratesi (Università, Pavia, Italy). Radiobiol. Latina, 4: 99-106(Apr.-June 1961). (In Italian)

Alterations in the diffusion of liquids in the skin and in its reactivity were compared in animals irradiated in the normal state and during hibernation. Intra-dermal injections of India ink and anti-variola vaccine were given in zones which had previously been irradiated with doses of 500 to 1500 r. It was concluded that x rays have a less intense effect on the skin of animals irradiated during hibernation, and a possible radiobiological interpretation of this phenomenon is suggested. (auth)

20214 ASPECTS OF THE GLOMERULAR MICROCIRCULATION AS A RESULT OF SELECTIVE RENAL IRRADIATION. A. De Silvestri, C. Piovella, and G. F. Mazzoleni (Università, Pavia, Italy). Radiobiol. Latina, 4: 107-15(Apr.-June 1961). (In Italian)

Irradiation of the frog kidney with very large doses (60000 to 120,000 r) initially provoked an increase in the passage of fluid through the glomerulus and edema of Bowman's space. Hyperemia of the periglomerular vessels and dilatation of the venules and capillaries accompanied by retardation and stasis of the capillary circulation in the irradiated zone comprised the hemodynamic picture most frequently seen after irradiation. After about 6 hr the hyperemia was followed by considerable renal ischemia; the authors discuss the significance of these changes in the circulation in the renal capillaries. (auth)

20215 CINEMICROGRAPHIC STUDIES ON THE GENESIS OF ANOMALIES IN INTERKINETIC NUCLEI AFTER IRRADIATION. E. G. Rondanelli, A. Trenta, J. Montero-Castillo, V. Vannini, and C. Scotti-Foglieni (Università, Pavia, Italy). Radiobiol. Latina, 4: 117-25 (Apr.-June 1961). (In Italian)

The mode of development of abnormalities of the interkinetic nuclei that are observed in irradiated cells is described. The genesis of these abnormalities, as studied in vitro in living erythroblasts of Tribon by cinemicrography, is attributed to arrest provoked by ionizing radiations during different phases of karyokinesis, followed by reconstruction of the interkinetic nucleus by the mitotic chromosomes. The abnormalities of the interkinetic nucleus, the development of which was studied, consisted of changes in diameter (increase or decrease of the mean nuclear diameter), in form (nuclei with single or multiple lobes) and in number of nuclei (multinucleate forms). (auth)

20216 STUDY ON THE EFFECT OF IRRADIATION OF SALIVARY GLANDS: HISTOLOGICAL MODIFICATIONS OF THE TESTICLES. R. Cortinovis, G. F. Mazzoleni, and C. Vassallo (Università, Pavia, Italy). Radiobiol. Latina, 4: 127-39(Apr.-June 1961). (In Italian)

Histological studies were made on salivary glands and on testicles of rats irradiated with increasing x-ray doses applied on the submandibular and lateral zones of the neck. It was observed that with strong x-ray doses, after 20 to 30 days an almost total destruction of parotid and submandibular glands had taken place, which corresponded in the testicle to sharp alterations of the spermatogenetic activity. Thirty days after ending the treatment, any histologically demonstrable testicular alteration had disappeared. Interpretative hypothesis of these phenomena are discussed. (auth)

20217 STUDIES ON THE EFFECTS OF IRRADIATION OF SALIVARY GLANDS: HISTOLOGICAL AND HISTOCHEMICAL MODIFICATIONS OF THE OVARY. G. F. Mazzoleni, C. Vassallo, and E. Zambetti (Università, Pavia, Italy). Radiobiol. Latina, 4: 141-55(Apr.-June 1961). (In Italian)

Histological and histochemical studies were made on ovaries of rats irradiated with increasing x-ray doses applied on the salivary glands in the submandibular and lateral zones of the neck. It was observed that with strong doses an almost total destruction of parotid and submandibular glands took place. In the ovary, ten days after irradiating treatment, the absence of advanced maturation phases of the egg was shown; these phases reappeared after fifty days. Interpretative hypotheses of phenomena observed are given. (auth)

20218 PROTECTIVE ACTION OF CARDIAC IRRADIATION ON THE ARRHYTHMIA INDUCED BY ADRENALINE AND NORADRENALINE IN DOGS ANESTHESIZED WITH CYCLOPROPANE. F. Neri, M. Marcato, L. Taverna, and D. Soregaroli (Università, Parma, Italy). Radiobiol. Latina, 4: 157-71(Apr.-June 1961). (In Italian)

A series of studies was made on dogs previously irradiated in the cardiac zone with moderate and fractionated doses, in order to observe the sensitivity toward adrenalin and noradrenalin during cyclopropanic anesthesia. It was observed that ionizing radiations exert an action that can be considered as protective against drugs that alter the rhythm. (auth)

20219 CHEMICAL PROTECTION IN LESIONS INDUCED BY RADIATIONS OF VARIOUS ENERGY LEVELS. M. Caprotti and L. Babini (Università, Pavia, Italy). Radiobiol. Latina, 4: 173-7(Apr.-June 1961). (In Italian)

The radioprotective action of cysteamine on mitosis in Vicia Faba Equina, irradiated at different energy levels was studied. The limited protective efficiency of cysteamine toward cells irradiated with ultrasoft radiations was shown. The most important mechanism of protective action is the neutralization of radicals liberated by ionizing radiations. (auth)

20220 ON THE PROBLEM OF CHRONIC RADIATION BURDEN. FURTHER RESULTS FROM IRRADIATION OF MICE WITH FRACTIONAL RADIATION DOSES. Hanns Langendorff and Margarethe Langendorff (Universitat, Freiburg i. B. and Heiligenberg-Institut, Ger.). Strahlentherapie, 118: 10-34(May 1962). (In German)

Mice, 500 female and 50 male, were irradiated daily with 2.5 r. After receiving different total dosages copulation occurred. Fertility, postnatal and infant mortality, sex ratio, and deformity rate were investigated in the descendents of the irradiated animals. An increased postnatal mortality was found, but mortality, size, and number of newborns were normal. A change in the sex ratio was not found up to the third generation. The frequency of the deformities was greater in the F_1-generation than in the following generations. (auth)

20221 RADIATION CONDITIONED DISTURBANCE OF TRITIUM INCORPORATION IN ORGANIC CELL SUBSTANCES. Adolf Zuppinger, Guelfo G. Poretti, Peter Zaoralek, and Hugo Aebi (Universität, Bern and Island Hospital, Bern). Strahlentherapie, 118: 42-5(May 1962). (In German)

A change of the tritium incorporation from intraperitoneally administered tracer amounts of tritiated water into the organic cell substance of the liver and brain occurred in total body irradiated mice. The disturbance showed a biphasic course. An initially strong increase of the incorporation changed into a negative phase at the end of the 2nd week after irradiation. (auth)

20222 ON THE QUESTION OF THE RADIATION BURDEN OF THE CELL NUCLEUS BY INCORPORATION OF TRITIUM-LABELED THYMIDINE. Hans A. Kuenkel (Universitäts, Hamburg-Eppendorf, Ger.). Strahlentherapie, 118: 46-53(May 1962). (In German)

Incorporation of H^3-labeled thymidine causes a selective irradiation of the cell nucleus because of the extremely short range of the β radiation of tritium. An estimation of this radiation response was made under two different presumptions: homogenous distribution of the substance within a cell nucleus of arbitrarily assumed size and point-shaped tritium source in the middle of a spherically assumed cell nucleus. It is shown, that the use of the conception "radiation dose" in those microscopic areas in the order of a few μ is neither allowable physically nor logical biologically. It is pointed out that there are genetic effects because of transformations of the nucleus caused by incorporation of tritium into the chromosomes in addition to the radiation injury produced by the incorporated H^3-thymidine. (auth)

20223 ON THE QUESTION OF THE RADIATION DAMAGE TO THE POPULATION BY MEANS OF DERMATOLOGICAL ROENTGENTHERAPY. Gustav Wagner (Universitäts, Kiel). Strahlentherapie, 118: 122-44(May 1962). (In German)

The genetic effects on populations caused by external radiation therapy are about 2.5 mr/person/year, using the limited observations reported previously. This value is about the same order as the genetic radiation effect on the population caused by watches with luminescent dials. Using the patient material of the x-ray department of the Universitäts-Hautklinik in Kiel it is demonstrated, that statistics can be set up and conclusions can be drawn for the different factors of the radiation effect. Patient material was compared with the results obtained from an American study which were similarly calculated. (auth)

20224 FURTHER INVESTIGATIONS OF THE BIOLOGICAL EFFECTS OF A FRACTIONATED ELECTRON IRRADIATION. Herbert Clemens, Dieter Hofmann, and Richard K. Kepp (Universitäts, Giessen, Ger.). Strahlentherapie, 118: 145-22(May 1962). (In German)

The importance of the duration of the interval between single irradiations was investigated, completing previous investigations about the influence of the fractionating degree upon skin- and tumor reactions at irradiation with electrons of Sr/Y^{90}. It appeared that at intervals of 12 and 24 hours the degree of the skin reaction decreases with the degree of the dose fractionation. Using an interval of 72 hours, the skin reactions, however, increased with stronger dose fractionation. This can be explained by the fact, that in case of long intervals the last few irradiations are given in a stage of considerable pre-damage (epitheliolysis), causing considerable necrosis. The effect on the tumor lessened with increasing fractionating and with increasing duration of the interval. However, the wanted retardation of the effect on the tumor was accompanied also by an increase of metastases. Considerations about an optimal dose distribution as a function of time at irradiation with fast electrons are discussed. (auth)

20225 CONCERNING THE EFFECTS OF SINGLE AND FRACTIONATED DOSES OF ROENTGEN RADIATION TO RAT TESTES. Spiro Gavalà and Felix Wachsmann (Universität, Bologna). Strahlentherapie, 118: 153-8(May 1962). (In German)

The classical experiments with the testes of rats by Ferroux, Regoud, and Samssonow concerning the effects of a constant total dose administered as a single dose and fractionated were repeated. The fractionating of 5 to 10 single doses was extended to 25 single doses. Histological samples taken on the 7th, 15th, 30th, 60th, and 90th day after irradiation was discontinued showed that a maximum effect appears on about the 15th to 30th day followed by a continued recovery beginning at the 60th day. A certain difference in the temporal course of damage and regeneration was shown, but there was no significantly stronger or weaker effect of the fractionally administered doses. The known increase in tumor effectiveness by fractionating could be proved experimentally by the non-appearance of the fractionating effect obtained in other tissues using the assumption that the seminal epithelium as a moulting tissue behaves very similar to tumor tissue. (auth)

20226 INACTIVATION STUDIES WITH HOMOZYGOUS YEAST STRAINS OF DIFFERENT PLOIDY. VI. THE SYNTHESIS OF EXTENSIVELY HOMOZYGOUS AND ISOGENIC PENTA AND HEXAPLOID STRAINS AND THE EFFECT OF A GIVEN MUTATED ALLELE ON THE RADIATION RESISTANCE. Wolfgang Laskowski (Freien Universität, Berlin). Z. Naturforsch, 17b: 93-108(Feb. 1962). (In German)

A series of extensively homozygous and isogenic Saccharomyces strains of different ploidy (haploid–hexaploid) was developed by controlled matings. The degree of ploidy was further checked by analysis of the segregation of mating type alleles and in case of the hexaploid strain also of two other markers. The genetic analysis was consistent with previous findings. Measurements of linear dimensions of the various strains indicated an increase of cellular volume proportional with ploidy. Radiation inactivation studies on the different strains with UV showed a maximum of resistance of the triploid strains and a decrease of resistance with further increase of ploidy from triploid to hexaploid. In x-ray and Po α-ray inactivation, diploid strains heterozygous in the mating type alleles showed a maximum of resistance, whereas diploids homozygous in the mating type alleles proved to be less resistant than triploids. Additional to the effect of the mating type alleles on the resistance to x rays and Po α rays ($a\alpha$ effect), there could be shown an effect of alleles controlling the dependence on the aminoacids serine and valine-isoleucine (AS-effect). Strains dependent on serine or valine-isoleucine proved to be more x-ray and Po α-ray resistant than related prototrophic strains. There is, however, no difference in the UV resistance. This AS effect is not present in haploid strains but only in strains of higher ploidy. The dose effect curves of strains exhibiting an AS effect or an $a\alpha$ effect show a characteristic difference. The AS effect is expressed by a constant dose reduction factor. The $a\alpha$ effect, however, produces dose effect curves that have a more expressed shoulder in the lower dose range than comparable curves of aa or $\alpha\alpha$ strains but run parallel to these curves in the higher dose ranges. Possible meanings of these findings are discussed. (auth)

20227 VLIYANIE IONIZIRUYUSHCHEGO IZLUCHENIYA NA VIRUSNYE INFEKTSII I PROTIVOVIRUSNYI IMMUNITET. (Effects of Ionizing Radiation on the Virus Infection and Antivirus Immunity). O. P. Peterson, O. N. Berezina, I. A. Kozlova, and E. I. Sklyanskaya. Moscow, State Publishing House of Medical Literature, 1961. 167p.

Effects of ionizing radiation on natural antivirus immunity and sensitivity to various viruses are investigated, as well as the effects of ionizing radiation on immunogenesis and acquired antivirus immunity. The book is designed for virologists, microbiologists, physicians, and research scientists. An extensive bibliography is included. (R.V.J.)

20228 PATOLOGOANATOMICHESKIE IZMERENIYA LEGKIKH PRI LUCHEVOĬ BOLEZNI. (Pathological Anatomic Changes in Lungs in Radiation Injuries). A. E. Ivanov. Moscow, Medgiz, 1961. 156p.

Systematic data are presented on pathological changes in lungs during radiation sickness induced by various types of radiation. Concepts on pathogenesis and histochemical changes in lungs of exposed animals are discussed. 266 references are included. (R.V.J.)

20229 ESTESTVENNAYA RADIOAKTIVNOST'. (Natural Radioactivity). I. M. Belousova and Yu. M. Shtukkenberg. Moscow, Medgiz, 1961. 220p.

Effects of natural radioactivity from cosmic radiation, gases, earth crust, open water basins, and atmosphere on living organisms were studied at various latitudes and altitudes. Chapters deal with nuclear structure and transformations, radiation reactions with substances, absorbed dose and biological effects, natural radioactive isotopes and their decay, radioactivity in plants and food products, organism metabolism, tissue doses from external radiation, inhaled doses, and permissible doses from fall-out. 150 references are included. (R.V.J.)

20230 MEDICAL AND BIOLOGICAL ASPECTS OF THE ENERGIES OF SPACE; SYMPOSIUM, OCTOBER 24, 25, 26, 1960. Paul A. Campbell, ed. New York, Columbia University Press, 1961. 500p.

Twenty-four papers are included; separate abstracts have been prepared on 16. Other papers cover gravitational phenomenon, energy conversion in photosynthesis, spectral efficiency in photosynthesis, periodicity of illumination and photosynthesis in space, the logistics of photosynthesis, and a summation of space energies. Author and subject indexes are included. (C.H.)

20231 ENERGIES OF SOLAR ORIGIN. R. Grant Athay (Univ. of Colorado, Boulder) and Walter O. Roberts. p.11-

19 of "Medical and Biological Aspects of the Energies of Space." New York, Columbia University Press, 1961.

Recent data are summarized on the energies of radiations of solar origin in the ultraviolet and particle spectrum. The data are based on balloon, rocket, and satellite observations. It is pointed out that the sum of all quantitative data represents only a meager part of what is needed before the full character of solar emission in the ultraviolet, x-ray, γ-ray, and particle regions of the spectrum is known. At present such indirect evidences of these radiations are furnished by geomagnetic storms, the aurorae, and ionospheric phenomena must be relied upon. 16 references. (C.H.)

20232 ENERGIES FROM COSMIC SOURCES: STARLIGHT, NEBULAE, AND COSMIC RAYS. Frank N. Edmonds, Jr. (Univ. of Texas, Austin). p.20-48 of "Medical and Biological Aspects of the Energies of Space." New York, Columbia University Press, 1961.

Data are reviewed on the source and energies of nonsolar cosmic radiations found within or near the solar system. The various quantities used in the description of cosmic energies and their pertinence to problems of utilization or shielding are discussed. The spectrum of electromagnetic radiation originating from cosmic sources other than the sun is compared with the solar spectrum. Various complications to the picture considered include the variation of radiation intensity with direction, appreciable emission restricted to specified wave lengths, important contributions from members of the solar system other than the sun, cosmic rays, and neutrino fluxes. 32 references. (C.H.)

20233 PARTICULATE CONTENTS OF SPACE. Fred L. Whipple (Smithsonian Astrophysical Observatory and Harvard Coll. Observatory, Cambridge, Mass.). p.49-70 of "Medical and Biological Aspects of the Energies of Space." New York, Columbia University Press, 1961.

A definite and reliable upper limit to the erosive action on metals by the total content of particulate matter in the general region of terrestrial planets is now known. This limit is discussed, and certain psychological aspects of meteoritic encounter are mentioned briefly. Certain restrictions on the solar corpuscular radiation are also considered. Rocket data on meteorite impacts and constants of frequency-mass equations are tabulated. 31 references. (C.H.)

20234 MAGNETIC FIELDS. Walter Dieminger (Max Planck Institut für Aeronomie and Univ. of Göttingen, Hanover). p.71-89 of "Medical and Biological Aspects of the Energies of Space." New York, Columbia University Press, 1961.

The strength of the geomagnetic field decreases with height according to an inverse cube law and the field probably terminates at a distance of 10 to 15 earth radii. It may be heavily disordered at very great altitudes by the intrusion of solar gas. Superimposed upon the steady geomagnetic field are regular and irregular variations which are thought to be caused by electric currents in the upper atmosphere. The origin of the geomagnetic field is as yet unknown although it has been used in navigation for over 4,000 years. The trapping of energetic particles by the geomagnetic field, or the so-called Van Allen belts, was demonstrated by satellites and space probes. The structure of the solar magnetic field at distances up to 60 solar radii has been studied by radio-astronomical methods. Findings to date are summarized. Magnetic fields of the moon and planets and magnetic fields and hydromagnetic waves in interplanetary space are discussed briefly. It is concluded that the magnetic fields of the earth, the sun, and in interplanetary space will not directly affect a space traveler. The possibility of gaining electric power from the magnetic fields in space is discussed briefly. 22 references. (C.H.)

20235 GEOMAGNETICALLY TRAPPED RADIATION AND INTERPLANETARY COSMIC FLUX: THE RADIATION ENVIRONMENT IN THE INTERIOR OF A SPACE VEHICLE. Alan Rosen (Space Technology Labs. Inc., Los Angeles). p.90-129 of "Medical and Biological Aspects of the Energies of Space." New York, Columbia University Press, 1961.

The characteristics of the penetrating radiation likely to be found in the extraterrestrial environment are summarized. Methods of attenuation of the radiation by shielding which may reasonably be expected to make up the wall surface of a space craft are considered. The characteristics of the radiation in various regions of space are considered, with emphasis on the Van Allen radiation belt. Experimental data obtained from satellites, as well as other sources, are reviewed. 31 references. (C.H.)

20236 RADIATION SOURCES CARRIED BY THE SPACE VEHICLE. Donald M. Ross (Office of Health and Safety, AEC). p.130-53 of "Medical and Biological Aspects of the Energies of Space." New York, Columbia University Press, 1961.

Concepts and devices being considered as possible sources of nuclear power for use in the establishment and maintenance of manned space stations, ion propulsion systems, and planetary bases are reviewed. Both auxiliary power systems and propulsion systems are considered. Topics discussed in detail include radioisotope power sources, reactor power sources, ion propulsion systems, and nuclear rockets. Radiation shielding requirements for the protection of the crew from radiation sources carried by the vehicle are considered. 15 references. (C.H.)

20237 ENERGY CONVERSION AND BALANCE IN MANNED SPACE VEHICLES. Hans G. Clamann (USAF Aerospace Medical Center, Brooks AFB, Tex.). p.193-206 of "Medical and Biological Aspects of the Energies of Space." New York, Columbia University Press, 1961.

The energy requirements for manned space vehicles are reviewed. Besides energy for lifting and propelling a space craft, energy is needed for navigation, orientation in space, data telemetering, sustaining man, and reducing speed in the re-entry phase. It is pointed out that the amount of energy needed can be determined fairly accurately for a given type of unmanned space craft and known mission. In contrast, when it comes to energy for sustaining man, general quantitative solutions cannot be offered because of a number of variable factors. Topics discussed in detail include energy requirements, the energies of space, and conversion of solar energy. The problems involved in constructing an axially symmetrical vehicle oriented towards the sun, one side of which is more reflective and the other more emissive, conflict with other requirements which call for an all-around shielding against meteorites, protons, electrons, and cosmic radiation. Suggested solutions are reviewed. 14 references. (C.H.)

20238 RADIATION TOLERANCES IN PHOTOSYNTHESIS AND CONSEQUENCES OF EXCESSES. Bessel Kok (Research Institutes for Advanced Studies, Baltimore) and Leonard H. Bongers. p.299-322 of "Medical and Biological Aspects of the Energies of Space." New York, Columbia University Press, 1961.

The effects of visible and ultraviolet light on photosyn-

thesis and the growth of algae are discussed from the standpoint of the biological consequences of excesses. Illustrative data on metabolic processes in Chlorella pyrenoidosa are tabulated. 58 references. (C.H.)

20239 THE INTERACTION OF PRIMARY COSMIC RAYS WITH MATTER AND TISSUE. Franklin Hutchinson (Yale Univ., New Haven). p.349-66 of "Medical and Biological Aspects of the Energies of Space." New York, Columbia University Press, 1961.

Galactic cosmic rays consist of ions of elements from H up to at least Fe, with energies ranging at least as high as 10^{18} ev. The interaction of these high-energy heavy particles with matter are discussed with emphasis on those aspects that are particularly important in evaluating effects on biological materials. Data are tabulated on the abundances of elements in cosmic rays as compared with relative abundances in the universe. Topics discussed include ionization energy loss, the spatial distribution of the energy loss, and nuclear interactions. 27 references. (C.H.)

20240 THE REACTION OF SECONDARY COSMIC RAYS WITH MATTER AND TISSUE. George W. Crawford (USAF Aerospace Medical Center, Brooks AFB, Tex.). p.367-80 of "Medical and Biological Aspects of the Energies of Space." New York, Columbia University Press, 1961.

The status of investigations into the biological effects of cosmic rays in extremely high altitude operations is summarized. Thorough studies are reported in progress on the biological effects of electrons, x rays, γ rays, protons, α particles, and neutrons to determine endpoints of interest. A solid state ionization chamber space probe is described that was used to obtain a representative proton count profile from which the time in the inner Van Allen radiation belt was determined. Sets of such solid state ionization count rate meters, each adjusted to measure protons in a given energy band, will be flown. Each package will also contain tissue equivalent dosimeters, and adjacent packages will count the electrons present. Thus the biological equivalent dose rate and total dose can be correlated to the electron and proton fluxes and energy distributions. Special studies are in progress to determine the hyper-responsive portions of the body to radiation and the fluxes most likely to cause this damage. 6 references. (C.H.)

20241 PROBLEMS IN SHIELDING. John E. Pickering, Ralph G. Allen, Jr., and Oskar L. Ritter (USAF Aerospace Medical Center, Brooks AFB, Tex.). p.381-90 of "Medical and Biological Aspects of the Energies of Space." New York, Columbia University Press, 1961.

Data on galactic and solar cosmic radiation indicate that the particle flux and dose rate are well below those that will produce any demonstrable detrimental biological effects. However, dose rates inferred in free space following a solar flare could yield demonstrable effects after a few hours exposure or even lethal effects if exposure occurred for a few minutes in the initial phase of the flare. Man's ability to protect himself from the radiations in space may be the limiting factor in manned space travel. In the vicinity of the earth, solar cosmic rays and the trapped radiation of the Van Allen belts will impose the greatest biologic concern and the most difficult shielding problems. These radiations have demonstrated characteristics of protons, electrons, and alpha particles with energies up to several Bev. Attenuation by matter is complicated by the variant energy of these particles as well as the production of secondary radiations. Optimization of shield design for size and weight may define vehicle configuration, payload, and mission. Recent data on the radiations of space are summarized and the attendant shielding problems are discussed. (C.H.)

20242 THE CHEMICAL AND BIOLOGICAL PROTECTION AND TREATMENT OF MAMMALS. John F. Thomson and Harvey M. Patt (Argonne National Lab., Ill.). p.391-407 of "Medical and Biological Aspects of the Energies of Space." New York, Columbia University Press, 1961.

Possibilities for the chemical and biological modification of radiation effects are reviewed from the viewpoint of a space environment. Reaction mechanisms involved in the protective effects of a number of chemicals are discussed. Data are tabulated on the comparative effectiveness of cysteine, cysteamine, cystamine, aminoethylisothiuronium, mercaptopropylamine, and 3-mercaptopropylisothiuronium bromide hydrobromide. The effectiveness of epinephrine, histamine, p-aminopropiophenone, sodium cyanide, morphine, serotonin, resperine, and other pharmacologic agents for radiation protection are reviewed. It is pointed out that protective effects demonstrated in small rodents are not found in dogs or monkeys. With the possible exception of serotonin, all known chemical protective agents must be given at doses near the lethal level. The maximum dose-reductant factor for acute lethality observed with the most effective compounds only approaches that which can be achieved by hypoxia. It is concluded that, except for antibiotics under certain conditions, nothing tested to date has been of any real radioprotective value. Applications of bone marrow injections in the post-irradiation treatment of man are discussed. The effectiveness of partial-body shielding for radiation protection is also discussed. It is concluded that none of the preparations examined as protective or therapeutic agents for radiation damage are effective and that total-body shielding is the only wholly effective measure for protection against radiation. 59 references. (C.H.)

20243 EFFECTS OF LOW-LEVEL REPEATED EXPOSURES OF IONIZING RADIATION. Gerrit L. Hekhuis (USAF Aerospace Medical Center, Brooks AFB, Tex.). p.408-14 of "Medical and Biological Aspects of the Energies of Space." New York, Columbia University Press, 1961.

Variables found to be important in determining biologic response to fractionation or protraction of radiation dose include total dose, time intervals, total exposure time, dose rate, and energy level. Ways in which these variables may modify the biologic results are discussed. It is concluded that present methods of dosage determination are inadequate, and there may be greater biologic variation in the responses of either test animals or humans than can be detected in experiments using low-dose radiation levels. 19 references. (C.H.)

20244 ELECTROMAGNETIC RADIATION. Titus C. Evans (Iowa State Univ., Iowa City). p.415-20 of "Medical and Biological Aspects of the Energies of Space." New York, Columbia University Press, 1961.

The radiation hazards from high-energy photons in space are considered. It is concluded that in space flight there will be a calculated risk in which physical conditions will be formulated to reduce as much as possible the volume dose and dose rate and to provide all possible protection to the bone marrow. It is pointed out that the quantity and quality of the radiation within a space craft will depend on the particles encountered and on the interactions of these with the materials of the craft itself. Shielding and other means of protection against both low-energy and ionizing photons are considered. (C.H.)

20245 PARTICULATE RADIATION: ELECTRONS AND PROTONS UP TO CARBON. Cornelius A. Tobias and Roger Wallace (Univ. of California, Berkeley). p.421-42 of "Medical and Biological Aspects of the Energies of Space." New York, Columbia University Press, 1961. (UCRL-9446)

Radiation hazards during space flight due to particulate radiations are discussed. It is pointed out that although the origin of cosmic rays may be in doubt, the general characteristics of the radiation have been described in detail. The characteristics of galactic and solar cosmic rays are reviewed, with emphasis on those constituents from electrons and protons up to carbon. Consideration is limited for the most part to cosmic rays as they exist at distances of several earth radii and further in the local solar system. The effects of secondary radiation produced by these cosmic rays when they impinge on the atmosphere, the effect of the geomagnetic field on the incident particles, and the effect that this has on radiation at various radii are discussed briefly. Radiation dosages for particles from protons to carbon at various altitudes above the earth are discussed as a function of geomagnetic latitude. The hazards from solar flares are also considered. 9 references. (C.H.)

20246 PARTICULATE RADIATION HEAVIER THAN CARBON. David G. Simons (USAF Aerospace Medical Center, Brooks AFB, Tex.). p.443-62 of "Medical and Biological Aspects of the Energies of Space." New York, Columbia University Press, 1961.

Information to date is summarized on the radiation effects of primary cosmic particles of carbon and heavier. Data are presented graphically showing the energy of primary galactic cosmic rays in the region of space occupied by the earth and the radiation characteristics most important in producing a given biological effect. Results are reviewed from studies on the effects of heavy primary particles and accelerated ions on various biological systems and materials. The experiments conducted to date have revealed no biological effects of sufficient seriousness to warrant concern for the health of the astronaut exposed to heavy primary cosmic radiation for a 24-hour period. 45 references. (C.H.)

Radiation Sickness

20247 THE ROLE OF ADRENAL CORTICAL HORMONES IN X RAY-INDUCED LIVER CHANGES. E. Stark, E. Zádory, and K. Lapis (Medical Univ., Budapest). Acta Med. Acad. Sci. Hung., 18: 127-30(1962). (In English)

Total-body irradiation of rats with 600 r produced severe degenerative lesions in liver which were evident by the 6th or 7th day. A dose of 400 r had no visible effects on liver and 500 r produced slight changes in some animals, seen as fat accumulation at the periphery of liver lobules. At the 600-r dose the following histopathologic changes were seen in liver: separation of trabeculae and dilatation of sinusoids in central portions of lobules, severe fatty infiltration at the center of lobules, and desquamation of sinusoid endothelial cells. In adrenalectomized rats, maintained on deoxycorticosterone acetate (DOCA), 600 r failed to produce any liver lesions in ~ half of the animals and fatty degeneration was mild in the remainder. In these animals, irradiation appeared to have no effect on the spleen and lymph nodes, which underwent hypotrophy as a result of adrenalectomy. In adrenalectomized rats treated with 1.5 mg/day hydrocortisone in addition to DOCA, irradiation produced the same liver lesions as in irradiated controls. Thus, glucocorticoid hormone appears to sensitize the liver to radiation injury. (H.H.D.)

20248 BLOOD PICTURE OF NAGASAKI ATOMIC BOMB SURVIVORS. Naomi Kageura, Shiro Osajima, and Masanobu Tomonaga (Nagasaki Univ.). Acta Med. Nagasakiensia, 5: 1-12(Apr. 1960)

Results of hematologic studies conducted in survivors between 1946 and 1956 are summarized. A total of 3234 subjects who were within 2000 m of the hypocenter of the explosion were examined and compared with 1607 unexposed controls. In 1946 anemia was presented in 71% of the exposed subjects and 44% of unexposed controls, based on blood hemoglobin levels below 80% of normal. In 1948 the values were 34 and 24%, respectively, indicating appreciable recovery from anemia in this 2-yr period. Leukopenia was found in 12% and 1.4% in 1946, but in 1948 and later the exposed group no longer showed a significantly higher incidence of leukopenia. Eosinophilia was lower in exposed subjects in 1946 but higher in 1948 than in controls. The percentage of persons showing decreased monocytes was higher in the exposed group in 1946-48 and lower in 1953, whereas in 1956 monocyte levels were identical in the 2 groups. Lymphocyte and basophil counts showed no differences in the 2 groups between 1946 and 1956, nor were differences detected in leukocyte peroxidase, catalase, and alkaline phosphatase activities. In the exposed group, 1 case of chronic myeloid leukemia was discovered in 1953 and 2 of basophil leukemia in 1956. Anemia in the exposed subjects was of the normocytic or macrocytic type, and these types also predominated in unexposed anemic subjects. Bone marrow biopsy in 1956 showed no differences between the 2 groups with respect to: total nucleated cell count, maturation of erythroblasts and granulocytes, or percentages of lymphocytes, plasma cells, and megakaryocytes. It was concluded that anemia, although prevalent in controls due to poor postwar nutritional conditions, was significantly induced by radiation; moreover, that recovery from anemia was gradual and eventually complete. Characteristic and persistent changes in eosinophilia could be related to radiation disease in the exposed group. (H.H.D.)

20249 HEMATOLOGICAL STUDIES ON THE ATOMIC BOMB SURVIVORS IN NAGASAKI (4TH REPORT). Shiro Osajima and Masanobu Tomonaga (Nagasaki Univ.). Acta Med. Nagasakiensia, 5: 13-23(Apr. 1960).

In 1953 and 1956 mass examinations of 6732 residents of Nagasaki were made. These subjects were classified into 3 groups: A, exposed within 2000 m of the hypocenter and showing signs of acute radiation injury (epilation, hemorrhagic tendency, stomatitis); B, exposed within 2000 m but without outward symptoms; and C, controls 2500 m or beyond the hypocenter. Leukocyte counts were lower in A and B than in C in 1953 but in 1956 the differences were not significant. Incidence of anemia was higher in A and B than in C in 1953 but not in 1956. Lymphocyte counts were similar in the 3 groups but monocytes and eosinophils were higher in A and B in 1953. In 1956, differential white cell counts were similar in all 3 groups. The results show that anemia attributable to radiation exposure in 1945 gradually diminished between this time and 1953-6. (H.H.D.)

20250 A STATISTICAL SURVEY OF MALIGNANT NEOPLASM MORTALITY AMONG ATOMIC BOMB SURVIVORS IN NAGASAKI. Satoshi Mori (Nagasaki Univ.). Acta Med. Nagasakiensia, 5: 43-53(Apr. 1960).

A survey of 11,424 death certificates issued in the city of Nagasaki between Jan. 1, 1953 and Dec. 31, 1957 showed 1347 cases dying of malignancy. In the latter group, 629 or 46.7% had histories of exposure to the explosion Aug. 9, 1945. The incidence of malignancy in this group is considered in terms of distance from the hypocenter of the explosion, radiation burns and other symptoms, age, sex, kind

of tumor, and national tumor mortality rate. Of the 629 exposed persons, only 21 were within 1500 m of the hypocenter, indicating that most of those within this diameter were killed instantly or died of radiation injury in the following months. Radiation sickness was recorded in 128 of the investigated cases; 132 were exposed outdoors at the time of the explosion while 281 were indoors (mostly in wooden buildings. Cancers of the digestive tract were most frequent, being present in 73% of men and 54% of women dying of malignancies. In women genital and gastric cancers were the next highest in incidence. However, only in malignancies of the lymphatic and hematopoietic systems was the incidence of neoplasia significantly higher in the exposed group than in Japanese in general. In the exposed persons, these neoplasias occurred in 6.2% of the men and 4.1% of women compared with national rates of 4.6 and 3.5%, respectively, suggesting that radiation may have contributed to development of these malignancies. Mortality from 1953 to 1957 in general was lower in Nagasaki prefecture (81.7 for men and 72.3 for women per 100,000) than in the exposed group (95.0, 84.3) and for the nation (94.3, 80.6). In age groups over 40, i.e., those most susceptible to cancer, the incidence of cancer in the exposed increased 0.02% in men and 0.04% in women from 1949 to 1954, but these increases are not significant. (H.H.D.)

20251 SIX CASES OF LEUKEMIA DISCOVERED BY MASS SURVEYS OF NAGASAKI ATOMIC BOMB SURVIVORS. Yasuro Kamochi (Hiroshima Univ.), Bunro Watanabe, Noboru Ozono, Masanobu Tomonaga, Michito Ichimura, Shigeki Toyoda, Masami Hamashima, and Yoshitane Kikitsu. Acta Med. Nagasakiensia, 5: 99-107(Oct. 1960).

Screening examinations conducted between 1954 and 1957 on 3333 survivors of the Nagasaki explosion revealed 6 cases of leukemia, the case histories of which are described in detail. Three cases in 15-23-year-old males represent early stages of chronic granulocytic leukemia. A 4th case was of acute granulocytic leukemia. Three cases were within 2000 m of the hypocenter, 2 within 2500 m (1 of whom was estimated to have received 29 rads), and the 6th was at 6220 m (where the radiation dose was very low). Leukemia in none of these cases could be directly attributed to radiation, although these and earlier studies show that the incidence of leukemia in Nagasaki and Hiroshima is considerably higher than the national average (20-30 per million per yr). The incidence is higher in exposed persons. Peak incidence of leukemia in these cities was recorded in 1951-2 and appears to be declining. (H.H.D.)

20252 THE EFFECT OF X RAYS ON ANAPHYLAXIS IN THE GUINEA PIG. B. Csaba, T. Szilágyi, Mária Kávai, I. Szatai, and F. Tóth (Medical Univ., Debrecen, Hungary). Acta Physiol. Acad. Sci. Hung., 20: 61-9(1961). (In English)

Guinea pigs were irradiated with a total-body dose of 200 r 7 days before active sensitization by a single intracutaneous dose of 5 mg ovalbumin. Over 50% of these animals survived a challenging dose of antigen 25 days later, whereas all of the nonirradiated animals died in acute anaphylactic shock within 3-4 min. When the same amount of radiation was given in fractional doses (10 r daily for 20 days), 30–40% of the animals survived anaphylactic shock. In guinea pigs passively sensitized by intracardiac injection of antiovalbumin, irradiation had no appreciable protective effect. Ileum isolated from these passively sensitized animals responded to the presence of antigen even after irradiation of the animals with 10,000 r. Irradiation of rabbit antiovalbumin immune serum with 10,000, 50,000, or 100,000 r failed to prevent its ability to elicit anaphylaxis and did not reduce its precipitin titer. In fact, irradiation of the antiserum increased the amount of precipitate it formed with antigen. The results confirm that radiation does not impair the reactivity of antibody and that it inhibits anaphylaxis by blocking antibody synthesis. (H.H.D.)

20253 EFFECT OF CELL-FREE TUMOR MATERIALS ON IRRADIATED AND NEWBORN ANIMALS. G. R. Spencer and R. W. Leader (Washington State Univ., Pullman). Am. J. Vet. Research, 23: 587-91(May 1962).

Whole-body irradiation of rats with 250 r increased the incidence of mammary tumors over a 16-month observation period. Females of this inbred strain developed these tumors spontaneously, and irradiation, in addition to augmenting their formation, promoted development of other types of mammary tumors, a glioma, and a fibrosarcoma of skin. Injection of culture fluid from tumor cells grown in vitro did not enhance development of tumors in irradiated rats or in nonirradiated controls. In fact, injections of fluid reduced the incidence of tumors in irradiated rats, suggesting a protective effect, but because of the small number of animals studied the results cannot be considered significant. The spontaneous rat mammary tumor, originally an adenofibroma, changed to a fibrosarcoma after 3 to 5 transplantations in rats of the same strain. Supernatant fluids and tissue culture fluids from spontaneously occurring tumors in dogs and cats when injected into newborn animals of the same species did not induce tumors in the recipients. (H.H.D.)

20254 THE EXCRETION OF ALDOSTERONE, CORTISONE, AND CORTISOL AS WELL AS SODIUM AND POTASSIUM AFTER RADIUM TREATMENT. G. Stark and A. Altinli (Universität, Mainz). Arch. Gynäkol., 196: 13-22(Apr. 1961). (In German)

Studies were conducted in 31 women with carcinoma of the cervix or body of the uterus before and 1, 2, and 3 days after Ra implantation. Urinary excretion of cortisol rose 7-fold 1 day after this procedure but returned to normal by the 3rd day. Excretion of aldosterone and cortisone were not significantly affected, nor was the excretion of total nitrogen, urea, and uric acid. Excretion of K was unchanged but that of Na decreased on days 2, 3, and 4, then rose to normal again by the 5th day. Water excretion was reduced the 1st day after Ra treatment. The increased glucocorticoid secretion and salt and water retention after Ra implantation were less marked than that observed postoperatively in patients undergoing surgery for the same types of carcinoma. (H.H.D.)

20255 EFFECTS OF TOTAL IRRADIATION OF THE RAT ON THE FREE ACTIVITY OF ACID DEOXYRIBONUCLEASE AND OF ACID PHOSPHATASE IN THE REGENERATING LIVER. M. Goutier-Pirotte and R. Goutier (Centre d'Etude de l'Energie Nucléaire, Mol, Belg.). Arch. intern. physiol. et biochim., 70: 154-5(Feb. 1962). (In French)

Rats were partially hepatectomized and irradiated with 700 r at various subsequent intervals. Homogenates were prepared of the regenerating liver, and in the supernatant fraction, obtained by centrifugation at 300,000 g for 30 min, determinations were made of the activity of acid-deoxyribonuclease (DNase), liberated into this fraction, and of another enzyme present in the lysozomes, acid phosphatase. Irradiation did not affect the free acid-DNase in nonhepatectomized rats but when given 2 hr before hepatectomy, it doubled this activity as tested 4 hr later. Irradiation given immediately after hepatectomy also doubled this activity by the 6th hr, but the activity returned to normal by the 18th hr. When the interval between hepatectomy and irradiation was prolonged (up to 24 hr), irradiation was

decreasingly effective in releasing free enzyme. Closely similar results were obtained with acid phosphatase as with acid-DNase. The rise in activity of free enzymes reflects a lesion in the lysosomes produced by radiation; apparently the lysosomes are most radiosensitive in the early stages of regeneration of liver. (H.H.D.)

20256 INFLUENCE OF IONIZING IRRADIATION ON THE EVOLUTION AND NEOSALVARSAN TREATMENT OF EXPERIMENTAL TRYPANOSOMIASIS IN THE RAT. N. Muntiu, N. Chelemen, T. Andrian, I. Corneci, I. Baditiou, and C. Iuga (Lab. of Veterinary Medicine, Ministry of Armed Forces, Bucharest). Arch. Roumaines Pathol. Exptl. et Microbiol., 20: 76-85(Mar. 1961).

Rats were irradiated with single doses of 627-703 r and immediately inoculated subcutaneously or intraperitoneally with 1, 10, 100, or 1000 trypanosomes (T. brucei). In untreated animals, irradiation appeared to have no influence on the incubation period or survival of infected animals, but it did depress the leukocytosis and splenic hyperplasia observed in infected controls. However, in animals treated with Neosalvarsan a distinct effect of irradiation was noted; doses of the arsenical that were 100% effective in eliminating the trypanosomes in controls were only 7% effective in irradiated animals. The results indicate that such therapeutic agents are only capable of eliminating the parasites in the presence of a functional reticuloendothelial system, which in these experiments was injured by radiation. (H.H.D.)

20257 INVESTIGATION OF THE ROLE OF IONIZING RADIATION IN EXPERIMENTAL INFECTION WITH PATHOGENIC STAPHYLOCOCCI. N. Nestoresco, S. Benes, and I. Strîmbeanu (Inst. Dr. I. Cantacuzino, Bucharest). Arch. roumaines pathol. exptl. microbiol., 20: 599-616 (1961).

Rabbits were irradiated with 50 r at 3- to 4-day intervals over a period of 44 days, giving a total radiation dose of 450 r. Three days after the last dose, a pathologic strain of Staphylococcus aureus was injected intravenously and the course of infection was followed in these and in infected-nonirradiated controls. The mortality by 90 days was twice as high in irradiated-infected than infected controls, whereas the irradiated-noninfected animals showed an intermediate mortality rate. The leukocytosis induced by infection was lower in irradiated animals, but agglutinin and antistaphylolysin titers were not appreciably lower in irradiated rabbits. Histopathologic changes were most marked in the irradiated-infected group and least severe in the nonirradiated-infected group, and these changes were most pronounced in intestine, spleen, and liver. Necrotizing-degenerative lesions in the central nervous system and adrenals could be attributed entirely to irradiation. (H.H.D.)

20258 THE EFFECT OF RADIATION AND POLYMYXIN B SULFATE ON THE SERUM BETA-GLUCURONIDASE ACTIVITY LEVEL IN CANCER PATIENTS: A PRELIMINARY REPORT. Mihály Bartalos and Ferenc Gyoerkey (Johns Hopkins Univ., Baltimore). Ann. Chir. Gynaecol. Fenniae, 51: 9-13(1962).

Serial serum β-glucuronidase activity determinations showed a consistently higher level in 50 cancer patients as compared with a group of healthy adults. In 1 group of these patients treated with radiation alone, the serum β-glucuronidase level rose in all reaching the highest peak about the 12th day. Another group of these cancer patients was treated with radiation and polymyxin B each day for 2 consecutive days. In all, the serum activity showed a sharp fall after the 2nd injection which was followed by clinical improvement. In order to exclude the possibility of a direct deactivating effect of radiation of β-glucuronidase in the circulating blood, the following in vitro experiments were performed. A pure crystalline enzyme was dissolved in distilled water to an approximately similar concentration to that found in cancer patients' serums with and without polymyxin and exposed to 50,000 r radiation. This did not lower the enzyme activity level. Pleural fluid from cancer patients showing high β-glucoronidase activity, with and without polymyxin, exposed to a similar dose of radiation showed no change in activity. (H.H.D.)

20259 OBSERVATIONS ON THE EFFECTS OF ROENTGEN PANIRRADIATION ON THE FORMED ELEMENTS AND CONTENT AND FRACTIONS OF PROTEIN IN THORACIC DUCT LYMPH OF THE RABBIT. Carlo A. Castelli (Università, Parma, Italy). Ateneo parmense, 32: 658-70 (Nov.-Dec. 1961).

Changes in the composition of lymph were investigated 1 hr. after rabbits were given whole-body radiation in doses of 100, 200, 300, 400, 500, 600, and 750 r. The % of lymphocytes in thoracic duct lymph progressively declined with increasing doses from 99.6% in controls to 76% at the highest dose. Monocytes showed an inverse relation to lymphocytes, rising from 0.4 to 14.6% at the highest dose. Eosinophilic and neutrophilic granulocytes also increased with increasing radiation doses. Total protein content of lymph fell with increasing doses from 4.35 g/100 ml in controls to 1.5 in those receiving 750 r, and albumin fell from 2.2 to 0.84. Similar (60-70%) decreases were noted in α-, β-, and γ-globulins. (H.H.D.)

20260 INFLUENCE OF COBALT-60 RADIATION ON HEMOGLOBIN FORMATION IN THE CHICK EMBRYO. G. R. Phillips, M. Hildinger, H. Schall, and F. Turba (Universität, Würzburg, Ger.). Biochem. Z., 335: 223-30 (Dec. 1961).

Fertile, 96-hr hen eggs (White Leghorn and New Hampshire breeds) were irradiated with 100-800 r from a Co^{60} source. Hemoglobin was obtained from the chicks at 1, 4, 7, and 18 days after hatching and fractionated by starch gel electrophoresis. Five hemoglobin fractions, designated I-V, were isolated from nonirradiated controls; no differences were found in relation to breed, but the electrophoretic patterns varied according to the age of the chicks. Irradiation with 500 or 700 r produced a new, rapidly migrating hemoglobin component (fraction IV), whose frequency of appearance increased proportionally with the radiation dose. With some doses the concentrations of components II, III, and IV diminished, possibly due to greater ease of oxidation of hemoglobin to methemoglobin in irradiated cases. Hematocrit was decreased by irradiation, to as low as one-third normal. The LD_{50} of irradiation in these experiments was found to be 700-800 r, and with doses exceeding 600 r the chicks exhibited central nervous system disorders and deformities, particularly of the extremities. (H.H.D.)

20261 EFFECTS OF ATOMIC RADIATIONS IN MAN. Héctor Manjarrez (Centro Materno-Infantil "Gral. Maximino Avila Camacho," Mexico City). Bol. soc. méd. centro materno-infantil "Gral. Maximino Avila Camacho," 11: 107-10(July-Aug.-Sept. 1960).

A review is presented. (H.H.D.)

20262 CONCERNING THE MUTUAL RELATIONS OF SPLEEN AND BONE MARROW IN RADIATION REACTIONS. R. Bauer and H. Hartweg (Universität, Tubingen, Ger.). Fortschr. Gebiete Röntgenstrahlen u. Nuklearmed., 96: 676-82(May 1962). (In German)

Irradiation of the spleen with 50 to 150 r led to a relative increase of granulocytic precursors in bone marrow. The

histological structure and cellularity of the marrow remained unchanged. Irradiation of the spleen three days after radiation damage to the marrow led to a delay in marrow regeneration. The shift to the right found in the white cells indicated that splenic irradiation results in the liberation of a factor which predominantly affects heteroplastic division. This factor was not identical with that which leads to hypersplenism. The effects of splenic irradiation in cases of chronic myelosis were in close agreement with the results of these experiments. (auth)

20263 AGING AT THE CELLULAR LEVEL: DIFFERENTIAL EFFECT OF TRANSPLANTED ISOGENIC LYMPHOID CELLS FROM OLD VERSUS YOUNG MICE. Leonard J. Cole (Naval Radiological Defense Lab., San Francisco). Gerontologia, 6: 36-40(1962).

Young adult mice of the $(C57L \times A/He)F_1$ strain were exposed to a single sublethal dose of x radiation (500 rad), followed by injection of isogenic spleen cells from young adult donors or from old donors. Forty days later they were challenged by injection of parental A-strain spleen cells. None of the mice given isogenic spleen cells from young donors died but 14 out of 16 mice given the cells from old donors died. This suggests that spleen cells from old animals have a relatively low proliferative potential and are unable to repopulate the radiation-depleted lymphoid tissue of the host and resist the injection of immunologically competent cells. (H.H.D.)

20264 STUDY ON CHANGES IN PERIPHERAL BLOOD PATTERNS IN RADIATION THERAPY OF PATIENTS WITH UTERINE CARCINOMA. Kanae Takata (Hiroshima Univ.). Hiroshima J. Med. Sci., 9: 233-51(Dec. 1960).

Hematologic effects are described in 159 patients submitted to x radiation therapy administered in 12-18 doses of 300-400 r. Hypochromic anemia was present in $^2/_3$ of the cases before therapy, presumably as a result of chronic uterine bleeding, and a further reduction in hemoglobin occurred after therapy. The decrease in hemoglobin was proportional to the radiation dose, and the decrease after 400-r doses was significantly greater than with 300 r. Changes in red cell counts paralleled those of hemoglobin. Total circulating leukocyte counts were decreased in 40-60% of the cases receiving 300 r and 55-75% in those receiving 400 r; neutrophils and lymphocytes were diminished but not in relation to the dose. Most patients showed elevated eosinophil counts after irradiation and the increase was dose-dependent. The results are interpreted in terms of radiation injury to the hematopoietic system. (H.H.D.)

20265 OBSTETRIC-GYNECOLOGICAL STUDY ON WOMEN RECEIVING IRRADIATION IN SMALL DOSES ON THE LOWER ABDOMEN. Akinori Kurata (Hiroshima Univ.). Hiroshima J. Med. Sci., 10: 1-22(June 1961).

The effects of diagnostic x-ray exposure on reproductive function and on the offspring were investigated in 105 women in comparison with 131 control women who had not received abdominal radiation. The estimated radiation dose applied to the ovaries in hysterosalpingography was 200 to 550 mr (average 400 mr) and in fetal roentgenography about 560 mr. The irradiated women reported a shorter duration and less amount of menstruation after as compared with before irradiation but menstruation parameters were similar in the irradiated and control groups. The average age at menopause was the same in the 2 groups. Pregnancy rate increased markedly after salpingography; it rose to 46% in women who had been infertile before this procedure. The frequency of spontaneous abortion was higher before irradiation (13.2%) than after (8.2%), whereas the frequency of stillbirths was the same in both instances. Although the sample was too small for definite conclusions, irradiation appeared to have no influence on the offspring with respect to sex ratio, weight at birth, and incidence of postnatal death. No malformed infants were born to the irradiated mothers. It was concluded that diagnostic x radiation at the doses employed have no significant effect on gonadal function or on the first generation offspring. (H.H.D.)

20266 SOCIAL AND MEDICAL INVESTIGATION OF LUNG CANCER AMONG ATOMIC BOMB SURVIVORS. PART I. Kiyoshi Shimizu, Mineo Watanabe, and Sadato Ito (Hiroshima Univ.). Hiroshima J. Med. Sci., 10: 51 (June 1961).

The incidence of lung cancer was investigated among patients treated for atomic bomb sequelae in Hiroshima from 1957 to 1960. A total of 1875 persons was treated, 32.8% men and 67.2% women. Lung cancer was detected in 1.7% of the entire group, or in 2.3% of the men and 1.4% of the women. All of the men with lung cancer were over 50 yr of age, whereas only 78% of the women were over 50. It was estimated that the older cancer patients were on the average more than 2.1 km from the hypocenter at the time of the explosion, but those who were indoors at the time were in most cases within 2.0 km of the hypocenter (most of those outdoors and within 2 km were killed). Survivors experiencing epilation were usually within 1.6 km and those with bleeding were within 2.0 km and were outdoors. Lung cancer in this group could not be attributed to smoking or to various occupational or environmental factors. (H.H.D.)

20267 REJECTION OF SKIN GRAFTS AND PRODUCTION OF SPECIFIC ISOHEMAGGLUTININS BY NORMAL AND X-IRRADIATED MICE. H. S. Micklem and J. A. H. Brown (Medical Research Council, Harwell, Berks, Eng.). Immunology, 4: 318-28(Oct. 1961).

The immune responses of normal and x-irradiated mice were compared by studying the survival of skin homografts and by following changes of isohemagglutinin titers in host serum. Male CBA mice were presensitized by intraperitoneal injection of spleen cells from strain A mice, and 7 days later were irradiated with 200, 400, or 750 rads, given at a rate of 73 rads/min. They were then grafted with A-strain skin on the 7th, 29th, or 91st day after sensitization. Graft rejection and hemagglutinin formation were both depressed by radiation in proportion to the dose given. The radioresistance of the hemagglutinin response was greater in mice sensitized by spleen cells than in nonsensitized mice. The 400-rad dose suppressed this response completely in nonsensitized mice although it only slightly retarded the rejection of 2 successive skin homografts. These results confirm that circulating antibody is not essential for the rejection of skin grafts. They also suggest that plasma cells are not involved in graft rejection and that these cells are most radiosensitive before actively synthesizing antibody, since irradiation one week after presensitization has relatively little effect on hemagglutinin production. (H.H.D.)

20268 EFFECT OF TOTAL BODY X IRRADIATION ON TUMOR METASTASIS. T. Ghose (Atomic Energy Establishment, Trombay, India and Indian Cancer Research Center, Bombay). Indian J. Med. Sci., 16: 135-8(Feb. 1962).

Mice were irradiated with two 150 r doses spaced 2 days apart and 1-2 days later were inoculated subcutaneously with a suspension of tumor cells (mammary adenocarcinoma). Four out of the 12 mice showed metastases 18 days later, whereas no metastases were noted in any of the 10 unirradiated control mice. (H.H.D.)

20269 CORTICOSTEROID EFFECT ON HEMATOPOIETIC FUNCTION IN RADIATION-INDUCED LEUKOPENIA. Nasseh Amin and Mahmoud M. Mahfouz (Cairo Univ.). J. Egypt. Med. Assoc., 44: 310-20(1961).

Circulating leukocyte counts were followed in 60 patients undergoing x irradiation for malignancy. In 44 cases leukopenia was observed. Administration of dexamethasone (5 mg 3 times daily for 1 week) to these patients produced a marked rise in leukocyte counts, particularly of granulocytes, but not to the preirradiation level. Radiation tended to produce a relative increase in eosinophils and monocytes and these were lowered by the steroid. However, the steroid did not influence the hemoglobin level. (H.H.D.)

20270 THE ROLE OF ANTIBODY IN RECOVERY FROM INFECTION WITH VACCINIA VIRUS. Robert M. Friedman and Samuel Baron (National Institutes of Health, Bethesda, Md.). J. Immunol., 87: 379-82(Oct. 1961).

The effect of x irradiation on recovery of guinea pigs infected with vaccinia virus was investigated. The animals were irradiated 24 hrs before infection with 300 r, a dose found to inhibit antibody response but not development of delayed skin sensitivity. The sequence of events following infection was the same as in unirradiated animals except that antibody could not be detected in serum up to 28 days after infection nor at any time in the lesion. Circulating antibody could be detected by the 38th day in irradiated animals, and delayed skin sensitivity was present as early as the 4th day. The results show that neutralizing antibody is not necessary for recovery from vaccinia infection and do not rule out the possibility that delayed hypersensitivity (or interferon) may be factors in recovery. (H.H.D.)

20271 THE EFFECTS OF PRETREATMENT WITH X RAYS ON THE PATHOGENESIS OF LYMPHOCYTIC CHORIOMENINGITIS IN MICE. I. HOST SURVIVAL, VIRUS MULTIPLICATION, AND LEUKOCYTOSIS. John Hotchin and Heribert Weigand (New York State Dept. of Health, Albany). J. Immunol., 87: 675-81(Dec. 1961.)

The over-all protective effect of different x-ray doses, the duration of the protective effect, and the effect of irradiation upon the peripheral leukocyte count and the virus titer were studied using 2 strains of virus and 3 strains of mice. Groups of mice received doses of x rays through the range of 200, 300, 400, 500, 600, and 800 r. One day after exposure to irradiation, one-half of each group was given an inoculation of 10^4 LD_{50} of the virus and the mice were then observed for 28 days for signs of disease and mortality. Under optimal conditions, 500 r protected for 4 to 8 days; this period coincided with severe leukopenia. X irradiation caused a slight increase in virus titer in brain and blood, while eliminating signs of disease. The period of protection following x-ray treatment coincides with the period of severe leukopenia, suggesting that white blood cells may be the agents responsible for the signs of disease. Lymphocytic infiltration of the infected tissues was inhibited by the x-ray treatment. The conclusion is made that infection with the virus used is intrinsically harmless, and the protective effect of x rays is due to a suppression of the disease-producing immune response of the host resulting in a state of tolerant immunity similar to immunological paralysis. (H.H.D.)

20272 THE EFFECTS OF PRETREATMENT WITH X RAYS ON THE PATHOGENESIS OF LYMPHOCYTIC CHORIOMENINGITIS IN MICE. II. THE PATHOLOGICAL HISTOLOGY. Doris N. Collins, Heribert Weigand, and John Hotchin (New York State Dept. of Health, Albany). J. Immunol., 87: 682-7(Dec. 1961).

Virus inoculated intracutaneously in mice produced lethal meningoencephalitis and hepatitis. However, x irradiation of mice with 500 r 24 hr before inoculation prevented the development of characteristic lesions and fatal disease. The host response to irradiation in the presence of the virus was similar to that of controls which had received irradiation only. The effect of x radiation at this dosage was depression and destruction of existing blood cells of the hematopoietic system without damage to the mechanism of regeneration; at the same time, it caused the elimination of the pathological changes normally associated with the infection. It is concluded that the irradiation eliminates a host cellular immune response, which is responsible for disease due to this virus. (H.H.D.)

20273 IMMUNOLOGIC STUDY OF ANTIBODY-FORMING CELLS IN MOUSE RADIATION CHIMERAS. Gino Doria, Joan Wright Goodman, Nazareth Gengozian, and Charles C. Congdon (Oak Ridge National Lab., Tenn.). J. Immunol., 88: 20-30(Jan. 1962).

Twelve-week-old $(101 \times C3H)F_1$ and $(C57BL/6 \times DBA/2)F_1$ mice were used as irradiated recipients or normal adult donors of hematopoietic tissues. Mice of both strains were given a single total-body exposure of 900 r. The ability of the long-term radiation chimeras to produce hemagglutinin (to sheep red cells) was greater in isologous than in homologous combinations. This was found for both fetal liver and bone marrow chimeras. In homologous chimeras, the spleen cells responsible for agglutinin production were of the donor type, regardless of the hematopoietic tissues and strain combinations used. Fetal liver and adult bone marrow contained potential or actual antibody-forming cells which, transplanted into an irradiated host, conferred to it an immune system of the donor type. The immune response of donor cells transplanted from homologous chimera spleens into irradiated recipients was qualitatively normal, but quantitatively subnormal. (H.H.D.)

20274 RADIOSENSITIVITY OF SPLEEN CELLS FROM NORMAL AND PREIMMUNIZED MICE AND ITS SIGNIFICANCE TO INTACT ANIMALS. T. Makinodan, Marvin A. Kastenbaum, and William J. Peterson (Oak Ridge National Lab., Tenn.). J. Immunol., 88: 31-7(Jan. 1962).

Experiments were carried out in a large number (1900) of 12-week-old male and female $(C3H \times 101)F_1$ mice. Nonimmunized isologous mice irradiated with 800-900 r were used for in vivo culture of spleen cells from normal and preimmunized donor mice exposed to 0-500 r. The donors were preimmunized with sheep red cells, and antibody response in the recipients was studied as a function of time, cell dose, and radiation dose to the donor. The slopes of the regression lines (activity by cell number) were not significantly different for primary and secondary antibody responses before and after various sublethal x-ray doses. The fitted regression $[C_m/C_k = 1 - (1 - e^{-0.0142X})^{2.72}]$ of the antibody-forming capacity of spleen cells as a function of x-ray dose was typical of a multi-target curve with an extrapolated number of 2.72 and a D_{37} value of 70 r. Exposure of either nonimmunized or preimmunized donor mice to 150 r caused a 70% decrease in antibody-forming capacity of spleen cells and 250 r caused a 90% decrease. No difference in antibody-forming ability was detected between spleen cells from unirradiated, nonimmunized donors, and preimmunized donors given 420 r. The finding that as few as 3.5% of the total spleen cells (remaining competent after 300 r), or $\sim 2 \times 10^7$ cells, are sufficient to give a maximum secondary antibody response suggests that a mouse may be able to respond to about 30 noncross-reacting antigens simultaneously, assuming that one competent cell can synthesize only one type of antibody. This

observation supports an earlier contention of the existence of an autoregulatory mechanism for antibody formation, possibly mediated by a humoral factor. (H.H.D.)

20275 TRANSFER OF RABBIT LYMPH NODE CELLS TO NEONATAL RECIPIENT RABBITS. T. N. Harris, Susanna Harris, and Miriam B. Farber (Univ. of Pennsylvania, Philadelphia). J. Immunol., 88: 199-205(Feb. 1962).

Previous experiments were continued by investigating the immunologic responsiveness of newborn rabbits to homologous spleen cells and the effect of a prior injection of other homologous cells. When lymph node cells were obtained from adult rabbits, incubated in vitro with a filtrate of trypsin-treated Shigella paradysenteriae, and transferred to irradiated neonatal recipient rabbits, agglutinins to Shigella appeared subsequently in the serums of these recipients. When approximately the same number of cells were given to neonatal and to adult recipients, the amount of antibody produced per transferred cell was estimated to be about $\frac{1}{8}$ as much in the neonatal as the adult recipient. However, with decreasing numbers of cells transferred to the neonatal rabbits, there was an increase in the highest relative values of antibody produced per cell until, when the number of cells were approximately proportional to the weights of the recipients, the maximum value for the amount of antibody per transferred cell in neonatal recipients was about $\frac{1}{2}$ of the level in 1-kg recipients. X irradiation of the neonatal recipients prior to transfer led to higher antibody levels than those found in nonirradiated litter-mates, in the same range of ratios as that found in older recipients. Cells obtained from lymph node draining sites of injection of heterologous anitgens did not lead to significantly different antibody titers than in the case of cells from uninjected donor rabbits. Neonatal recipient rabbits previously injected with rabbit leukocytes, even on the first day of life, yielded lower agglutinin titers after lymph node cell transfer carried out one week later. Complete suppression of the antibody-inducing effect of transferred lymph node cells was found after the injection of 10^7 leukocytes, and decreasing degrees of suppression in the case of 10^6 and 10^5 leukocytes, respectively. Thus, the day-old rabbit can respond immunologically to leukocytes and requires approximately the same number of cells for antigenic stimulation as older rabbits. (H.H.D.)

20276 THE EFFECT OF TOTAL BODY X IRRADIATION OF THE RABBIT ON THE REJECTION OF HOMOLOGOUS SKIN GRAFTS AND ON THE IMMUNE RESPONSE. Marcus S. Brooke (Harvard Univ., Boston). J. Immunol., 88: 419-25(Apr. 1962).

The effect of sublethal (400 r), midlethal (600 r), and near-lethal (1100 r) total-body irradiation on the ability of rabbits to reject homologous skin grafts, to develop delayed hypersensitivity, and to form circulating antibodies to bovine γ-globulin (BGG) and sheep erythrocytes was studied. Different intervals were allowed to elapse between x irradiation and the presentation of antigens. Maximum prolongation of skin graft rejection time occurred with 400 r when grafting was done on the same day as irradiation. A 2-fold increase in the median rejection time was observed, and the occasional animal retained its graft for as long as 7 to 10 times the normal. No great advantage appears to be gained by increasing the radiation dose from 400 to 600 r and it is possible that prolongation of skin graft rejection time by irradiation can be as well obtained with a sublethal as with a midlethal dose. The time between irradiation and grafting appears to be as critical as the dose. The ability of the animal to develop delayed hypersensitivity to old tuberculin was greatly reduced when the antigen was given within hours of irradiation. Heavier doses of irradiation (600 and 1100 r) appear in many instances to permanently suppress the animal's ability to develop delayed hypersensitivity. There was a high degree of correlation between the time of rejection of skin grafts and the development of hemolysins; the shorter the skin graft rejection time, the higher the hemolysin titer. No correlation was obtained between skin graft rejection time and the anti-BGG titers. (H.H.D.)

20277 THE THROMBOCYTOSIS-PRODUCING ACTION OF THE SERUM OF SPLENECTOMIZED AND OF X-IRRADIATED MICE IN UNTREATED MICE. K. Rak, F. Kirzsa, and I. Cserhati (Univ. of Szeged). Med. Exptl., 5: 91-7(1961). (In German)

Splenectomy of mice caused a 50% rise in circulating platelets 8 days later, whereas whole-body irradiation with 500 r produced a 20% rise 2 days later followed by an 80% fall by the 10th day. Serum taken from these mice at various times was injected into other mice and platelet levels in the recipients were followed. Serum from mice 2-3 days after splenectomy caused a 50% rise in platelets, which is earlier than the change noted in the donors. Serum from mice irradiated 5 days earlier diminished platelets in recipients 35%, whereas 10-day serum raised it 50%. The action of this 10-day serum was destroyed by heating to 56° or incubation with trypsin. Hence the thrombopoietic factor in the serum of irradiated mice is a heat-labile protein. (H.H.D.)

20278 CLINICO-MORPHOLOGICAL CONFRONTATIONS IN THE SURGICAL TREATMENT OF RADIATION INJURIES. E. D. Savchenko, N. N. Garvei, and N. P. Mordvinova (State Scientific-Research Inst. of Roentgen-Radiology, Dept. of Health, USSR). Med. Radiol., 7: No. 4, 47-53(Apr. 1962). (In Russian)

Clinico-morphological confrontations of data obtained during studies of 35 patients who had undergone surgical treatment for radiation ulcerations of the skin were carried out. All the complications arising during treatment could be explained by the morphological picture assessed following studies of the removed operative material. Pathohistological and clinical confrontations show that apparently healthy tissues surrounding the ulcer are actually sharply changed. However, they may not be manifested clinically for a long time. The changed tissues do not represent a homogenous morphological picture, they requently combine destructive and reparative processes. Proper preparation of patients with radiation injuries and choice of a correct surgical technique ensure a stable healing of radiation ulcers. (auth)

20279 RADIATION-INDUCED HYPERPYREXIA IN RABBITS. O. M. Meredith and Camille Finnegan (Univ. of California, Los Angeles). Nature, 194: 592-3(May 12, 1962).

Studies were made of the rise in body temperature induced by acute radiation exposure in rabbits. The heads of female Dutch rabbits were irradiated with 100 to 800 r x rays and the rectal temperatures followed at hourly intervals for 4 hr after irradiation. The results show a hyperpyretic response with a threshold between 100 and 200 r; however, an oral dose of 200 mg/kg of aminopyrine was sufficient to block the response. It is concluded that the radioinduced febrile response is evoked through the hypothalamus. (D.L.C.)

20280 WHOLE-BODY OXYGEN CONSUMPTION DURING IRRADIATION FOR THE SURVIVAL OF RATS AFTER EXPOSURE TO X-RAYS. Antonín Vacek (Inst. of Biophysics, Czechoslovak Academy of Sciences, Brno). Nature, 194: 781-2(May 26, 1962).

Studies were made on the relation between whole-body oxygen consumption during irradiation and the survival of rats irradiated with 600 and 700 r x rays. Both doses showed positive correlation, that is, rats showing a high oxygen consumption survived for a longer time than rats with low consumption. (D.L.C.)

20281 DOSE EFFECT CURVE OF SOMATIC MUTATIONS IN EPHESTIA KÜHNIELLA Z. FOR LOW DOSE-RANGE (0-200r). I. Mueller, E. A. Löbbecke, and O. Oltmanns (Universität, Cologne). Nature, 194: 783-4(May 26, 1962).

Groups of Ephestia kuhniella Z. (meal moth) pupae were irradiated with 0, 10, 20, 40, 80, and 200 x rays and both wings of each individual examined for scale mutations. The results for the most frequent type of mutants (ES 1) show that in the range of 20 to 1000 r the mutation frequency is proportional to the square of the dose, whereas for 0 and 10 r this relation no longer holds good. (D.L.C.)

20282 'ADAPTATION' OF A LINE OF MOUSE BONE MARROW TO AN INCOMPATIBLE STRAIN. P. L. T. Ilbery and S. M. Winn (Univ. of Sydney). Nature, 194: 941-2(June 9, 1962).

Lethally irradiated CBA mice were given bone marrow and embryo liver cells from a (C57BL × T6)F_1 litter of ~17 days gestation. Further passages were made to lethally irradiated CBA and C57BL mice, and cytogenetic examination was made of the hemopoietic tissues of the surviving animals to determine whether the marked chromosome was still present. The results show that the marker remained in an unbroken line through three transplant generations of (C57BL × T6)F_1 hemopoietic tissue to the incompatible CBA hosts and that adaptation does occur in recovery from secondary disease. (D.L.C.)

20283 RECOVERY EFFECT OF HIGHLY POLYMERIZED HOMOLOGOUS LIVER DEOXYRIBONUCLEIC ACID INJECTED INTO LETHALLY IRRADIATED RATS: HISTOLOGICAL EXAMINATION OF THE SPLEEN AND BONE MARROW. V. Pantić (Univ. of Belgrade), N. Stošić, D. Kanazir, A. Bećarević, and G. Jovicki. Nature, 194: 942-4(June 9, 1962).

Histological examination was made on the radioinduced changes in the spleen and bone marrow of rats exposed to a $LD_{100/30}$ of x rays, treated with homologous native liver DNA, and killed on the 4th or 9th day after irradiation. It is concluded that the spleen and bone marrow of the lethally irradiated rats treated with DNA are less damaged than the untreated controls. The reticular cells are not so much altered and there are more lymphopoietic elements in the spleen and myelopoietic and erythropoietic elements in the bone marrow. (D.L.C.)

20284 RADIATION PROTECTIVE EFFECT OF ETHYL PALMITATE. Kurt Flemming (Biophysikalische Abteilung des Heiligenberg-Instituts, Ger.). Naturwissenschaften, 49: 87(1962). (In German)

A study was made to determine whether ethyl palmitate exerted a radiation protective effect in x-irradiated mammals in the same manner as a surgical splenectomy. White mice, aged 7 to 10 weeks and weighing 20 to 23 g, received intravenous injections of ethyl palmitate before irradiation. The survival rate of mice treated with this compound sharply increased. It is suggested that the protective effect of ethyl palmitate can be described as a chemical "splenectomy." (J.S.R.)

20285 POSTIRRADIATION PROTECTION AND RECOVERY. PART VI. EFFECTS OF ESTERS OF UNSATURATED FATTY ACIDS ON GONADS OF X-IRRADIATED MALE MICE. M. Maqsood (Univ. of California, Berkeley). Pakistan J. Sci. and Ind. Research, 5: No. 1, 1-5(Jan. 1962). (In English)

Administration of esters of certain unsaturated fatty acids, i.e., methyl oleate, and methyl stearate, within an hour following whole-body x irradiation of male mice at 625 r[LD_{30}(30)], accelerated the rate of cellular regeneration in the testes of these animals when compared with the untreated x-irradiated ones, on the 30th day postirradiation. On the other hand, esters of certain other unsaturated fatty acids adversely affected the rate of cellular regeneration in the testes of x-irradiated mice. These differences may, in part, be due to differences in the composition of the esters of unsaturated fatty acids used in these experiments. There are indications that lipid therapy, by restoring the cell functions, accelerates the rate of cellular regeneration in the x-irradiated animals. (auth)

20286 OXIDATIVE PHOSPHORYLATION IN RATS IRRADIATED WITH Co^{60} AND TREATED WITH HOMOLOGOUS HOMOGENATES OF LIVER, KIDNEY AND SPLEEN. Paolo Erede and Anna Maria Podesta (Università, Genoa). Pathologica, 53: 359-64(Nov.-Dec. 1961).

Adult rats were irradiated with 450 r, given in 2 daily doses of 225 r, and oxidative phosphorylation was investigated in homogenates of liver removed 1 to 7 days later. Within 5 days this process was markedly diminished as shown by a decrease of P/O ratio of liver to 1.8 compared with 2.9 in control animals, as determined from O uptake of the homogenates and conversion of inorganic to organic P. On the basis of P/O values, this impairment of oxidative phosphorylation was not prevented by intraperitoneal injection of homogenates of rat liver, kidney, or spleen. Liver homogenate, or nuclear, mitochondrial, and supernatant fractions thereof, from the irradiated rats were injected into normal rats. The livers of rats injected with the supernatant fraction from irradiated rats showed impaired oxidative phosphorylation, the P/O ratio being 2.0 compared with 2.9 in control liver homogenate. (H.H.D.)

20287 THE SERUM PROTEIN LEVELS IN RATS IRRADIATED WITH Co^{60} AND TREATED WITH HOMOLOGOUS HOMOGENATES OF SPLEEN AND LIVER. Paolo Erede and Anna Maria Podesta (Università, Genoa). Pathologica, 53: 365-8(Nov.-Dec. 1961).

Serum proteins were studied by paper electrophoresis in rats after irradiation with 450 r, either in 2 daily doses of 225 r or in a single dose. Eight days after the single dose, total serum protein levels were unaffected but albumin fell to 1.82 g% from a control level of 2.64, α_1-globulin increased to 1.06 g% from 0.64, and more moderate increases of β- and γ-globulin levels also occurred. These changes were less marked in rats given two 225-r doses. When homogenates of spleen and liver from rats irradiated with a single 450-r dose were injected into normal rats, serum protein levels changed in the same way as in irradiated rats but to a less marked extent. For example, after injection of homogenates of irradiated spleen, albumin fell to 2.29 g% from 2.64 and α_1-globulin rose to 0.88 from 0.64. Liver homogenate was slightly less effective than that of spleen. The results indicate that a factor is produced in irradiated tissue which is capable of altering serum protein levels. (H.H.D.)

20288 EFFECTS OF SUB-LETHAL RADIATION DOSES ON THE CYCLE AND OESTRUS OF THE WHITE LABORATORY MICE. PART I. INVESTIGATION OF NORMAL CYCLE AND OESTRUS DURATION. Johannes Trautmann and Gisela Millin (Moabit City Hospital, Berlin). Strahlentherapie, 118: 67-76(May 1962). (In German)

Good correlation of the duration of both cycle and oestrus was found in 3 experiments, which were done at 3 different

time periods under the same experimental conditions using non-irradiated female white laboratory mice of the same strain. These results, obtained with the vaginal smear procedure, point out that information about the effects of ionizing radiation on the female gonads can be obtained by determining the duration of both cycle and oestrus using the vaginal smear procedure. (auth)

20289 EFFECT OF CONTINUOUS LOW-DOSE GAMMA IRRADIATION ON HEALING OF STANDARDIZED WOUNDS IN THE ALBINO RAT. Sidney O. Brown, James T. Jones, and Richard Thomas (Agricultural and Mechanical Coll., College Station, Tex.). Texas Repts. Biol. and Med., 20: 39-46(Jan. 1962).

Rats were subjected to prenatal and postnatal total-body continuous radiation at 10 and 20 r/23-hr day from a Co^{60} source until they were 16 weeks of age. Male rats were used for studies of the influence of life-time chronic irradiation on the tensile strength of wounds, and female rats were employed in the experiment involving burn healing. When the rats were 16 weeks of age, incisions were made on half of the animals, and burns were administered to the others. The incisions were 8mm in length and were made next to the dorsal midline; the burns were administered on an area about 12 × 45 mm in water at 98°. Neither the wounds nor the burns showed a decrease in tensile strength or healing attributable to exposure to chronic irradiation. There were no significant differences seen in repair time between irradiated animals and controls. (H.H.D.)

20290 THE ACTION OF X RADIATION ON THE FORMATION AND ACTIVITY OF ULTRAVIOLET-THROMBOPOIETIC FACTOR IN THE MOUSE. I. Cserhati, F. Krizsa, E. Sovenyi, and K. Rak (Medical Univ., Szeged). Z. ges. exptl. Med., 135: 355-60(1962).

Further experiments were conducted on the humoral factor activated by ultraviolet radiation which causes thrombocytosis (C. and R., ibid, 133, 38(1960)). Serum drawn 24 hrs after ultraviolet irradiation of mice when injected into recipient mice increases the circulating thrombocyte count 55%, whereas additional 300-r x irradiation of the donor reduces this increase to 20%. When x radiation (which produces thrombocytopoenia 10 days later) was given 9 days before ultraviolet radiation, no such transmissible factor could be demonstrated. When x radiation was given 24 hrs after ultraviolet radiation, the thrombocyte count was increased 30% in recipients of the serum. Irradiation of the recipient mice with 300 r completely abolished the effect of serum from ultraviolet-irradiated mice, and the thrombocyte count fell 60%, the same level produced by injection of serum from control donors. The results indicate that the thrombocytopoietic factor is itself radiosensitive as well as its target, the megakaryocytes of bone marrow. (H.H.D.)

20291 ACTION OF RADIATION ON ENDOCRINE REGULATORY PROCESSES. E. Lippert (Schliessfach, Vienna). Z. ges. inn. med. u. ihre Grenzgebiete, 16: 1081-4(Dec. 15, 1961).

The effects of high-energy radiations on biological systems are reviewed and a hypothesis is developed to account for the secondary effects of radiation. A 3-phase process is envisioned in which molecular structures undergoing alteration in the primary ionizing reaction act upon neuro-endocrine systems, particularly the hypothalamic-hypophyseal system, which by their secretory products alter cell metabolism and function. Thus the side effects of radiation at the cellular level include increased permeability, altered membrane potential and diminished excitability, impaired regeneration potentiality, and ultimately cell death. These secondary effects of radiation are considered as analogous to natural aging processes but occurring at a greatly accelerated rate. (H.H.D.)

20292 THE EFFECT OF CYSTEAMINE ON THE X-RAY SENSITIVITY OF T2 BACTERIOPHAGES DURING THEIR INTRACELLULAR CYCLE. H. Marcovich (Institut Pasteur, Paris). Z. Naturforsch., 17b: 23-8(Jan. 1962). (In German)

Radioprotection of phage T2 and of the monocomplex E. coli B/T2 was studied. Phage T2 is protected by cysteamine under conditions that exclude indirect effect mechanisms. Although there is no oxygen effect on this virus observable by removing the gas by physical means, it is suggested that the protector cysteamine acts by reducing some oxidized groups of the phage. The monocomplex can be protected only during the first five minutes of the latent period. The late monocomplex and the capacity of E. coli B to reproduce T2 are not protected by cysteamine. To explain these results it is assumed that the molecules involved in the capacity-inactivation by X-rays are in a reduced state, in contrast to the structures whose alteration is responsible for the killing of the bacteria. (auth)

20293 THE EFFECT OF CYSTEINE AND CYSTEAMINE CONCENTRATIONS ON THE INACTIVATION OF X-IRRADIATED T PHAGES. G. Hotz and A. Mueller (Kernforschungszentrum, Karlsruhe, Ger.). Z. Naturforsch., 17b: 34-7(Jan. 1962). (In German)

The plaque forming ability of T1 and T2 bacteriophage was inactivated by x rays. The protective action of different concentrations of the sulfhydryl compounds cysteine and cysteamine in broth, buffer, and water was investigated. T1 and T2 showed marked differences in the amount of protective cysteine molecules necessary for the same dose reduction factor. Also the formation of phage-sulfhydryl complexes was observed in T2 but not in T1. In protein-free solutions the inactivation of T1 can be varied with cysteamine concentration from highest sensitivity obtained in water to maximum resistance which is not changed by the addition of broth. (auth)

20294 THE COMBINED PROTECTIVE EFFECT OF CYSTEAMINE AND GLYCERINE IN X-IRRADIATED T1 PHAGES. G. Hotz (Kernforschungszentrum, Karlsruhe, Ger.). Z. Naturforsch., 17b: 37-42(Jan. 1962). (In German)

The plaque forming ability of coliphage T1 suspended in glycerol solutions was inactivated by x rays. A marked decrease in radiosensitivity was observed which was highest at a glycerol molarity of 10. At higher concentrations the protective effect decreases but this decrease could be avoided by adding cysteamine before irradiation. It was found that the protection afforded by 0.15 M cysteamine was additive to that observed with glycerol from zero concentration to 10 M. The highest ratio of sensitivity obtained was 6 as observed between T1 phage suspended in a cysteamine–glycerol–broth mixture and broth-suspended T1 without any addition. Tentative explanations are given for the remarkably efficient radioprotective actions found and some consequences thereof for further work are indicated. (auth)

20295 ATLAS PATOLOGICHESKOI ANATOMII OSTROI LUCHEVOI BOLEZNI V EKSPERIMENTE. (Atlas of Pathological Anatomy in Acute Radiation Sickness in Experiments). L. V. Funshtein. Leningrad, Medgiz, 1961. 221p.

An atlas is presented of the pathology of radiation sickness induced by external and internal irradiation. Morphological changes following fatal stages and early stages of acute sickness, as well as the recovery stages, are shown pictorially. (R.V.J.)

CHEMISTRY

General and Miscellaneous

20296 (ANL-6477) CHEMICAL ENGINEERING DIVISION SUMMARY REPORT, OCTOBER, NOVEMBER, DECEMBER 1961. (Argonne National Lab., Ill.). Mar. 1962. Contract W-31-109-eng-38. 231p.

Progress is reported on chemical–metallurgical processing, fuel cycle applications of volatility and fluidization techniques, calorimetry, reactor safety, energy conversion, determination of nuclear constants, and reactor decontamination. Separate abstracts were prepared for each topic. Routine operations are also reported. (M.C.G.)

20297 (ANL-6477(p.29-105)) CHEMICAL–METALLURGICAL PROCESSING. R. K. Steunenberg, L. Burris, Jr., et al. (Argonne National Lab., Ill.).

Pyrometallurgical development is reported on melt refining, processes utilizing liquid metal solvents, supporting chemical investigations, and supporting engineering studies in liquid metal systems. The design and construction of fuel processing facilities for EBR-II are described. Research progress is reported on solubilities in liquid metals, coprecipitation studies, liquid-liquid distribution studies, and thermodynamic studies. (M.C.G.)

20298 (ANL-6477(p.106-54)) FUEL CYCLE APPLICATIONS OF VOLATILITY AND FLUIDIZATION TECHNIQUES. J. Fischer, R. L. Jarry, et al. (Argonne National Lab., Ill.).

Laboratory and engineering-scale investigations of the Fluoride Volatility Processes are described. Topics covered include: fluorination of PuO_2–UO_2, plutonium particulate filtration from laboratory exhaust systems, gamma irradiation of plutonium compounds, kinetics of reaction of nickel with fluorine, direct fluorination of UO_2 pellets, recovery of uranium from enriched U–Zr alloy fuels, conversion of UF_6 to UO_2, and fluid-bed calcination studies in small-diameter columns. (M.C.G.)

20299 (ANL-6477(p.155-67)) CALORIMETRY. W. N. Hubbard, H. M. Feder, et al. (Argonne National Lab., Ill.).

Heats of formation of ZrH_2 and ZrD_2 were determined by combustion in oxygen. Heats of formation of boron, silicon, titanium, and hafnium fluorides and silica were determined also. (M.C.G.)

20300 (ANL-6477(p.168-203)) REACTOR SAFETY. L. Baker, E. Mouradian, et al. (Argonne National Lab., Ill.).

Reactor safety studies included investigations of metal oxidation and ignition kinetics and metal–water reactions. Calculations were made of the burning temperatures of metals in air. The emissivity of U and UO_2 was determined. (M.C.G.)

20301 (ANL-6477(p.204-16)) ENERGY CONVERSION. C. E. Crouthamel, M. Foster, et al. (Argonne National Lab. Ill.).

Operation of a regenerative lithium hydride fuel cell system for converting nuclear energy to electricity is being studied. The program of research in thermoelectric methods for direct conversion of nuclear reactor heat energy into electrical power was continued. (M.C.G.)

20302 (ANL-6477(p.217-23)) DETERMINATION OF NUCLEAR CONSTANTS. C. E. Crouthamel, D. C. Stupegia, and E. H. Dewell (Argonne National Lab., Ill.).

Neutron capture cross sections are being determined for Np^{237}, Er^{170}, Gd^{158}, Lu^{175}, Yb^{176}, and Mo^{98}. (M.C.G.)

20303 (ANL-6477(p.224-30)) REACTOR DECONTAMINATION. W. B. Seefeldt, D. Grosvenor, et al. (Argonne National Lab., Ill.).

Studies are being made to determine the seriousness of fuel element ruptures in boiling-water reactors and the methods of decontamination of contaminated surfaces. Data were obtained on the relative absorption of Ce^{141}, Ru^{103}, Cs^{137}, and Zr^{95} in a stainless steel loop which simulates the action of a boiling-water reactor. (M.C.G.)

20304 (CRL-73) LOOKING TO THE FUTURE. A POSSIBLE SPECTROCHEMICAL SOURCE. G. Zotov (Atomic Energy of Canada Ltd., Chalk River, Ont.). Apr. 1962. 5p. (AECL-1501)

Presented at the 8th Ottawa Symposium on Spectroscopy, September 1961.

An approach towards an ideal spectrochemical source is suggested. One electrode of the source is to be a cylinder which is both turned and advanced past a self-cleaning counter electrode disk while being sparked. The curved surface of the cylinder is to be coated with a sample deposit by means of a mass separator. The deposit thus made will consist of thin smears of elements displaced along the length of the cylinder according to mass and along the circumference according to boiling point. By exciting each element separately and in minute amounts the source is expected to yield spectra of absolute line strengths. (auth)

20305 (UCRL-10023) CHEMISTRY DIVISION ANNUAL REPORT, 1961. J. M. Hollander, F. L. Reynolds, and J. C. Wallmann, eds. (California. Univ., Berkeley. Lawrence Radiation Lab.). Jan. 1962. Contract W-7405-Eng-48. 304p.

A review of progress is presented concerning nuclear chemistry. It is noted that while the report is not exhaustive, an effort was made to give a balanced view of the wide research interests and problems of the Division. The research activities are reported on radioactivity and nuclear structure, fission, nuclear reactions, physical chemistry, instrumentation, and chemical engineering. Also included are abstracts of 15 graduate theses by students who did their research work in the Division. (J.R.D.)

20306 ACID-CATALYZED HYDROGEN-DEUTERIUM EXCHANGE REACTIONS OF DEUTERATED ANISOLE, THIOANISOLE AND BENZENE. Shigeru Oae, Atsuyoshi Ohno, and Waichiro Tagaki. Ann. Rept. Radiation Center Osaka Prefect., 2: 111-14(1961). (In English)

The H-D exchange reactions of p-deuterated anisole and thioanisole and of mono-deuterated benzene were investigated in acetic acid containing sulfuric acid as catalyst. Anisole was found to react 30 to 40 times faster than thioanisole, and thioanisole in turn reacts 50 times faster than benzene. (D.L.C.)

20307 THE CARBON-12 SCALE OF ATOMIC MASSES. Abbas Labbauf (Texas Agricultural and Mechanical Coll., College Station). J. Chem. Educ., 39: 282-6(June 1962).

The adoption of a unified atomic weight scale based on the use of C^{12} as the reference mass scale is discussed. Topics covered include the concept of atomic weight, the rise and coexistence of two scales, proposals for unification of the two scales, and adoption and use of C^{12} unified scale. A comparison is presented of the atomic and molecular weights of some nuclides and substances in terms of the chemical, physical, and C^{12} scales in order to show

what changes in molecular properties can be expected. (M.C.G.)

20308 ELECTRON SPECTRA OF THE PHENANTHRENES $C_{14}H_{10}$ AND $C_{14}D_{10}$ AT LOW TEMPERATURE. Louise Pesteil and Madeleine Rabaud (Laboratoire de Physique, Faculté des Sciences, Marseilles, France). J. chim. phys., 59: 167-76(Feb. 1962). (In French)

The study of the structure of the fluorescent and phosphorescent spectra at low temperature of the phenanthrenes in solution has permitted the establishment of a comparison table between the vibrations of the two compounds. The large number of oscillations is attributed to two possible causes: deformation of the molecule or interference of vibrations which are not completely symmetrical. (tr-auth)

20309 THE CHEMISTS' CONTRIBUTION TO NUCLEAR ENERGY. F. R. Paulsen. Nuclear Energy, 243-6(June 1962).

The role of chemistry in the development of nuclear energy is discussed. Chemical studies described include: preparation of heavy water, removal of sodium oxide from liquid sodium, production of high-purity alkali metals, evaluation of zirconium behavior in contact with other materials, niobium extraction, chemical separation of radioactive materials, waste disposal, and fuel processing. (M.C.G.)

20310 PALLADIUM CATALYST FOR LIQUID PHASE COMBINATION OF HYDROGEN AND OXYGEN. (to U. S. Atomic Energy Commission). British Patent 897,808. May 30, 1962.

A method is given for preparing an improved palladium catalyst for combining hydrogen or deuterium with oxygen in aqueous thorium oxide slurries with or without uranium oxide. The method comprises preparing a sol of thorium oxide calcined at 650°C and containing palladium nitrate at a concentration of at least 0.05 g/g of thorium oxide, contacting the sol with hydrogen until the sol is converted to a flocculated suspension, and adding the recovered solids to a slurry for catalytic action. The catalytic performance of such a catalyst is more than 4 times greater than that of palladium catalysts prepared by a previous dispersion method. (D.L.C.)

20311 IMPROVED PHOSPHORYLATED CELLULOSE AND METHOD OF OBTAINING IT. Ronald Alfred Wells, Arthur John Head, and Norman Frank Kember (to United Kingdom Atomic Energy Authority). British Patent 899,284. June 20, 1962.

A method is outlined for obtaining a phosphorylated cellulose suitable for adsorption of thorium from acidic aqueous solutions containing phosphoric acid. In this method, cellulose is treated with phosphoric acid containing an excess of a basic nitrogen compound, e.g., urea, for a curing time sufficient to combine all the phosphorus with the cellulose. The phosphorylated cellulose in salt form is converted into hydrogen form by acid treatment, washed with water to remove the acid, and allowed to stand in contact with water in order to improve its adsorbent properties. (D.L.C.)

20312 ADVANCES IN CHEMICAL ENGINEERING. VOLUME II. Thomas B. Drew and John W. Hoopes, Jr., eds. New York, Academic Press Inc., 1958. 342p.

Summaries are presented of recent work in chemical engineering. Topics covered include boiling of liquids, automatic process control, treatment and disposal of wastes in nuclear chemical technology, high vacuum technology, separation by adsorption methods, and mixing of solids. Separate abstracts were prepared for 4 of the 6 papers. (M.C.G.)

20313 BOILING OF LIQUIDS. J. W. Westwater (Univ. of Illinois, Urbana). p.1-31 of "Advances in Chemical Engineering. Volume II." New York, Academic Press Inc., 1958.

Transition boiling, film boiling, boiling of subcooled liquids, and bumping during boiling are discussed. Photographic studies are described. Experimental data are reviewed. (M.C.G.)

20314 TREATMENT AND DISPOSAL OF WASTES IN NUCLEAR CHEMICAL TECHNOLOGY. Bernard Manowitz (Brookhaven National Lab., Upton, N. Y.). p.81-116 of "Advances in Chemical Engineering. Volume II." New York, Academic Press Inc., 1958.

Methods and facilities for control of radioactive wastes are discussed. Sources of wastes are described. Waste disposal as a consideration in site selection, waste treatment and disposal practices, recovery of fission products from radiochemical wastes, and other waste problems are discussed. (M.C.G.)

20315 HIGH VACUUM TECHNOLOGY. George A. Sofer and Harold C. Weingartner (Nuclear Development Corp. of America, White Plains, N. Y. and Arthur D. Little, Inc., Cambridge, Mass.). p.117-45 of "Advances in Chemical Engineering. Volume II." New York, Academic Press Inc., 1958.

Freeze drying, reduction of magnesium, vacuum melting, isotope separation, vacuum-tube manufacture, vacuum coating, vacuum metallurgy, and vacuum drying are discussed in a review of the development of high vacuum technology. Uses in measurements of mass, fluid flow, heat transfer, and reaction equilibrium are outlined. Vacuum pumps and gages are described. (M.C.G.)

20316 SEPARATION BY ADSORPTION METHODS. Theodore Vermeulen (Univ. of California, Berkeley). p.147-208 of "Advances in Chemical Engineering. Volume II." New York, Academic Press Inc., 1958.

The problems of data interpretation and apparatus design in separations utilizing adsorption and ion exchange are discussed, with major emphasis on fixed-bed operations. The physical factors affecting separation performance are described including equilibrium, stoichiometric capacity, and rate behavior. Column dynamics under linear equilibrium and at a constant separation factor were studied for binary fixed-bed separations. Chromatographic separations were also investigated. (M.C.G.)

Analytical Procedures

20317 (HW-72199) APPLICATION OF THE CESIUM TETRAPHENYLBORATE EXTRACTION TO THE MEASUREMENT OF URANIUM BURNUP. A. C. Leaf (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Apr. 1962. Contract AT(45-1)-1350. 13p.

The cesium tetraphenylborate extraction method was adapted for the measurement of uranium burnup in aged reactor fuels. Cs^{137} was extracted from a neutral solution of 0.01 M (ethylendinitrilo) tetraacetate (EDTA) into 0.05 M sodium tetraphenylborate (TPB) in amylacetate. The extractant was counted directly using a 3-inch NaI(Tl) well crystal and gamma scintillation spectrometer. The addition of EDTA as a masking agent made possible the use of a single extraction by reducing the extraction of Ce^{144}, Ru^{106}, and $Zr\text{-}Nb^{95}$ to a nondetectable level. Occasionally, certain "species" of ruthenium were extracted even in the presence of EDTA. Digestion with sodium hydroxide converted the ruthenium to a nonextractable form. Decontamination

factors for the major fission products were estimated to be greater than 10^4. The average recovery from Cs^{137} spike solutions was 100.7 ± 0.8 percent, (standard deviation). The average result from the analysis of an American Society for Testing Materials (ASTM) comparison sample was $2.60 \pm 0.05 \times 10^7$ dis/min/ml compared to $2.60 \pm 0.05 \times 10^7$ dis/min/ml by the perchlorate method. (auth)

20318 (IA-690) LITHIUM AND LITHIUM-6 ANALYSIS BY COUNTING DELAYED NEUTRONS. S. Amiel and Y. Welwart (Israel. Atomic Energy Commission, Tel-Aviv). Jan. 1962. 22p.

The neutron precursor N^{17} is produced by the successive nuclear reactions $Li^6(n,\alpha)t$ and $O^{18}(t,\alpha)N^{17}$ by irradiating aqueous solutions of Li salts with termal neutrons. The delayed neutrons of N^{17} are used for the assay of Li. The total neutron emission is directly proportional to the Li^6 content. An emission of about 40,000 neutrons is obtained from a solution containing 1 mg Li^6 irradiated to saturation at a flux of 10^{12} n/cm^2-sec. By using solutions of O^{18}-enriched water, a corresponding increase in the neutron count and the sensitivity of the analysis are obtained. Interference by possible neutron-producing and neutron-absorbing, as well as other impurities is discussed. (auth)

20319 (K-1476(Rev.1)) GRAVIMETRIC FACTORS FOR URANIUM IN SELECTED COMPOUNDS. W. D. McCluen and F. H. Anderson (Oak Ridge Gaseous Diffusion Plant, Tenn.). May 31, 1962. Contract W-7405-Eng-26. 28p.

Revised gravimetric factors for pure U compounds are presented. Atomic weights of all elements, and nuclidic masses of the U isotopes, are based on the scale in which the nuclidic mass of C^{12} is exactly equal to 12 units. These factors recognize the presence of U isotopes 234 and 236 as they exist in U in the gaseous diffusion complex. (auth)

20320 (NAA-SR-6986) A DEVICE FOR CONTINUOUS DETECTION OF HYDROGEN IN SODIUM. H. Strahl (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). May 31, 1962. Contract AT-11-1-GEN-8. 26p.

A device to detect the presence of H in Na was developed. As little as 1 ppm H (based on flowing Na inventory) can be detected in a flowing Na stream at 500 to 1200°F with response times in the order of 5 seconds. Such a device, installed in a Na-heated steam generator, would signal the presence of water in the Na resulting from a leak in the Na-water barrier. (auth)

20321 (NP-11608) ACTIVATION ANALYSIS OF LIGHT ELEMENTS BY MEANS OF CHARGED PARTICLES. J. A. B. Heslop (Gt. Brit. Admiralty Materials Lab., Poole, Dorset, England). Apr. 1961. 14p. (AML-A/58(M))

When the light elements from boron to fluorine are bombarded by protons, deuterons, or alpha particles, a number of nuclear reactions occur leading to the formation of short-lived nuclides. Among these are C^{11}, N^{13}, and F^{18} which are sufficiently long-lived to be of potential value in activation analysis by charged-particle bombardment with subsequent radiochemical separation. The method is limited by numerous mutual interferences, but it is shown that there are good grounds for supposing that sensitive analyses are possible for all these elements, as was demonstrated for boron in earlier work. The concept of an activation integral is used to relate thick target sensitivities to excitation data, and sensitivities are tabulated for 25 significant reactions. Some general recommendations are made for experimental work to be carried out. (auth)

20322 (PG-Report-122) THE FATE OF RUTHENIUM-106 ON IGNITION OF SEAWEED (PORPHYRA) DURING ANALYSIS. C. J. Riley (United Kingdom Atomic Energy Authority. Production Group, Windscale, Sellafield, England). 1962. 16p.

The sample is ashed at 450 to 500°C. Gamma activity measurements of dried seaweed and seaweed ash show that there is no serious loss of Ru during ignition. (J.R.D.)

20323 (PG-Report-312) ANALYTICAL METHOD FOR THE DETERMINATION OF RUTHENIUM-103, RUTHENIUM-106, CAESIUM-137, ZIRCONIUM/NIOBIUM-95 AND CERIUM-144 IN SHORE SAND AND SEA SILT SAMPLES. (United Kingdom Atomic Energy Authority. Production Group, Windscale, Sellafield, England). 1962. 16p.

Ru^{103}, Ru/Rh^{106}, Cs^{137}, Zr/Nb^{95}, and Ce^{144} in samples of shore sand and sea silt are estimated by a γ-spectrometric method. The presence of two other γ-emitting isotopes, K^{40} and I^{131}, is normally assumed and they can also be determined. Ce^{141} is also present, but does not affect the method since the 0.14 Mev photopeak is not used to detect Ce^{144}. The contribution of each radionuclide to the γ-ray spectrum is determined by means of simultaneous equations derived from data obtained by scanning the pure radioisotopes under the same conditions of geometry and over the same energy range. (auth)

20324 (TID-15661) DEVELOPMENT OF KRYPTON-85 CLATHRATE ANALYTICAL TECHNIQUES TO MEASURE OXIDATION-REDUCTION PRODUCTS IN THE LIQUID STATE. Quarterly Technical Status Report No. 3, January 1, 1962 to March 31, 1962. George J. Rotariu and Elizabeth L. Hoskins (Booz-Allen Applied Research, Inc., Glenview, Ill.). Apr. 26, 1962. Contract AT(11-1)-1061. 37p.

Construction of a suitable apparatus is reported for testing reactions of metal ions in crystalline and liquid environment with hydroquinone–Kr^{85} clathrate. Results of work with ferric ion-radioactive clathrate indicates a positive reaction of this ion as the ferric-TTA complex and as the hydrated chloride in the presence of HCl gas. H_2O_2 is determined since it decomposes the clathrate in the presence of water. The liquid suspending medium, α,α,α-trifluorotoluene gives a relatively high clathrate decomposition. Heptacosafluorotributylamine is scheduled for evaluation as a suspending medium. (J.R.D.)

20325 (NP-tr-895) A RAPID METHOD OF DETERMINING THORIUM, RADIUM AND LEAD IN ACCESSORY MONAZITES. K. S. Ivanova. Translated by J. J. Cornish (U.K.A.E.A. Atomic Energy Research Establishment, Harwell, Berks, Eng.) from Radiokhimiya, 3: 348-55(1961). 20p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 15, abstract no. 32121.

20326 A WARBURG APPARATUS WITH AUTOMATIC RECORDING OF RESPIRATORY $^{14}CO_2$. Jostein Goksoeyr (Univ. of Bergen, Norway). Anal. Biochem., 3: 439-47(June 1962). (In English)

A radiorespirometer, constructed as a modified Warburg apparatus, is described. The radioactivity is determined directly in the alkali cup, which is fastened on to a small G-M tube inserted in the cover of the Warburg flask. The contents of both the main compartment and the alkali cup are agitated by magnetic stirring. The G-M tubes from each flask are connected via a time switch to a rate meter and a recorder. The setup makes it possible to work with four flasks with G-M tubes simultaneously. For respiratory measurements, Warburg's direct method is used, with a corresponding number of flasks without alkali and G-M tube. Curves are shown to demonstrate the kinetics of $C^{14}O_2$ absorption in the alkali cup and the registration of radioactivity. (auth)

20327 SPECTROGRAPHIC DETERMINATION OF IMPURITIES IN RARE EARTHS. C. Capdevila Pérez and F. Alvarez González (Junta de Energia Nuclear, Madrid). Anales real soc. espãn. fís. y quím. (Madrid), Ser. B, 58: 13-18(Jan. 1962). (In Spanish)

A spectrographic method was developed for the determination of 18 trace elements in lanthanum, cerium, praseodymium, neodymium, and samarium compounds. The concentrations of the impurities cover 0.5 to 500 ppm. Most of these impurities are determined by the carrier distillation method. Several more refractory elements have been determined by total burning of the sample with a d-c arc or by the conducting briquet excitation technique with a high voltage condensed spark. The work has been carried out with a Hilger Automatic Quartz Spectrograph. (auth)

20328 A PROCESS FOR THE DETERMINATION OF URANIUM IN ORES. S. Amiel (Weizmann-Institute of Science, Rehovoth, Israel). Atomwirtschaft, 7: 217-19 (Apr. 1962). (In German)

A process for the rapid determination of fissionable nuclides (e.g., uranium or thorium) in ores is described. This method of analysis depends on the measurement of the delayed neutrons which emerge after nuclear fission. It is a non-destructive process and is independent of chemical composition or of physical form since the measurement cannot be influenced by other elements. Detection sensitivities of less than 1 μg were attained. The main disadvantage of the method lies in the requirement of a reactor as a radiation source. The use of neutron sources with a small emitted flux is basically quite feasible but results in a considerably lower measurement accuracy and sensitivity. The measurement time in this method amounts to only about 2.5 min which is inclusive of the time required to change the specimens for irradiation in the pneumatic transfer tube container. Over 100 analyses could be carried out in an eight hour working day. Over a hundred specimens were irradiated in the Israel 5 Mw swimming-pool, research reactor at power levels between 10 kw and 1 Mw corresponding to a thermal neutron flux of 3.75×10^{12} n/cm^2-sec. The measurements were compared with the results of fluorimetric analysis and a good agreement is shown. A further advantage of the process is its applicability over a wide range of uranium concentrations. The measuring technique is described in detail and special attention is given to possible sources of error. (auth)

20329 EXTRACTION AND SPECTROPHOTOMETRIC DETERMINATION OF PENTAVALENT PROTACTINIUM BY COMPLEX FORMATION WITH THENOYLTRIFLUOROACETONE. Boris Mjassoedov and Roland Muxart (Institut du Radium, Laboratoire d'Arcueil, France). Bull. soc. chim. France, No. 2, 237-9(Feb. 1962). (In French)

The green color of benzene solutions of the chelated complex which pentavalent Pa forms with thenoyltrifluoroacetone in 6M hydrochloric acid is used for a colorimetric determination of pure Pa^{231}. The system considered follows Beer's law at 430 and 440 mμ in the concentration range between 1.3 and 8.7 μg of Pa^{231} per cm^3. (tr-auth)

20330 QUANTITATIVE DETERMINATION OF COBALT, ARSENIC, AND MANGANESE IN NUCLEAR STEELS BY THE METHOD OF NEUTRON ACTIVATION. Serge May and Guy Pinte (Centre d'Etudes Nucleaires, Saclay, France). Bull. soc. chim. France, No. 2, 287-90(Feb. 1962). (In French)

The nuclear steels used in reactors should have well-defined norms from the point of view of secondary components or impurities. For low concentrations of elements, the technique of neutron activation analysis is very useful because it is very sensitive. Cobalt, arsenic, and manganese were determined systematically in steels of different origins. The manganese can be determined without chemical separation. The results obtained are in good agreement with the values given by purely chemical methods. (tr-auth)

20331 X-RAY SPECTROSCOPY IN THE CLINICAL LABORATORY. VI. ACID-LABILE PROTEIN-BOUND IODINE (PBI). Samuel Natelson and Bertrum Sheid (Roosevelt Hospital, New York). Clin. Chem., 8: 17-34 (Dec. [1961]).

In the serum of patients given NaI^{131} orally, PBI was determined as follows: Two ml of serum acidified with 1 ml N HCl was extracted with 3:1 ethanol–ether to remove PBI. The extract was evaporated at 80° to near dryness and the residue was dissolved in 1 ml 10:1 methanol–concentrated NH_4OH. This solution was evaporated on filter paper and exposed to an x-ray field, L_α radiation being evaluated by a flow proportional counter. A multiple-ring oven is described for confining this evaporating solution to a small area of the paper. The residue from the ethanol–ether extract can be oxidized to elemental I and steam distilled onto filter paper. The x-ray method is more precise than other procedures; standard deviation of ±3%. The results were 6% lower than those obtained by an ashing procedure involving the ceric-arsenite reaction. The mean normal PBI level in human serum by the x-ray method was 4.7 μg/100 ml, with a range (2σ) of ±0.6. (H.H.D.)

20332 A NEW METHOD FOR THE SEPARATION OF STRONTIUM FROM RUBIDIUM FOR Rb-Sr ISOTOPE DILUTION ANALYSIS. W. G. Deuser (Pennsylvania State Univ., University Park). Geochim. et Cosmochim. Acta, 26: 515(Apr. 1962). (In English)

A new method was developed by which it is possible to separate strontium from rubidium by wet chemical means. The procedure is both fast and reproducible and leads to a separation sufficient for undisturbed isotopic analysis of the strontium. In almost all cases the separation is sufficient to yield very satisfactory strontium analyses and is comparable to an ion exchange separation. No difficulties were encountered down to 3.5 μg of Sr (spike included) in a sample with a Sr/Rb ratio of 0.0087. (P.C.H.)

20333 MICRO EXCHANGE METHOD FOR THE MASS SPECTROMETRIC DETERMINATION OF DEUTERIUM IN WATER. P. Jordan and C. Tgetgel-Schelling (Technische Hochschule, Zurich). Helv. Chim. Acta, 45: 703-11(1962). (In German)

A method is described for the mass spectrometric determination of deuterium in water, which operates without the introduction of water into the mass spectrometer. The sample to be analyzed is subjected to a catalytic deuterium exchange with molecular hydrogen, whose deuterium content was determined mass spectrometrically. (tr-auth)

20334 A METHOD FOR THE ASSAY OF CALCIUM-45 BY LIQUID SCINTILLATION COUNTING. T. E. F. Carr and B. J. Parsons (Medical Research Council Radiobiological Unit, Harwell, Berks, Eng.). Intern. J. Appl. Radiation and Isotopes, 13: 57-62(Feb. 1962). (In English)

A liquid scintillation technique is described whereby Ca^{45} can be assayed at high efficiency (55%) over a calcium carrier range of 0.1 to 300 mg, with no necessity for self-absorption corrections. Comparisons are made between this method and some of the standard techniques for the assay of Ca^{45}. (auth)

20335 A SIMPLE METHOD FOR THE ASSAY OF CARBON-14 IN COMPOUNDS OR MIXTURES. L. A. Walker and R. Lougheed (Mason Clinic, Seattle, Wash.).

Intern. J. Appl. Radiation and Isotopes, 13: 95-7(Feb. 1962). (In English)

A method is presented for the rapid and quantitative oxidation of water-soluble C^{14} compounds or mixtures of compounds, to C^{14}-labeled CO_2. The $C^{14}O_2$ is absorbed into a carbonate-free NaOH solution. The C^{14} may then be determined by precipitation of the C^{14} as barium carbonate and counting. Total carbon is determined by titration of an aliquot of the $NaOH-Na_2CO_3$ mixture to both the phenolphthalein and brom cresyl green end-points. For the oxidation of samples of pure C^{14}-lactic acid, 800 mg $K_2S_2O_8$ was adequate for the complete and quantitative oxidation of amounts of lactic acid equivalent to 13 mg of carbon. Replicate results for total carbon recovery on pure lactic acid solutions yielded recoveries of 97 to 100%. (M.C.G.)

20336 EVALUATION OF QUARTZ FOR NEUTRON ACTIVATION STUDIES. J. P. Shedlovsky and W. E. Mott (Gulf Research and Development Co., Pittsburgh). Intern. J. Appl. Radiation and Isotopes, 13: 97-8(Feb. 1962). (In English)

In the hope of finding some quartz that would be more suitable than that previously used for activation purposes, samples from several suppliers were irradiated and analyzed for antimony and total induced activity. The results indicated that synthetic fused silica can be used to an advantage in many activation studies. (M.C.G.)

20337 NEUTRON ACTIVATION ANALYSIS OF HOMOGENIZED CHICKEN. P. Kruger and I. J. Gruverman (Nuclear Science and Engineering Corp., Pittsburgh). Intern. J. Appl. Radiation and Isotopes, 13: 106-10(Feb. 1962). (In English)

Activation analysis of ashed homogenized whole chicken was performed to determine the important elements contributing to neutron-induced activation. Concentrations of Ca, P, K, Na, Cl, Zn, Fe, Mn, Cu, and S were computed by a direct comparison of the activity determined in the ash and in the pertinent comparators. The work demonstrated the applicability of the activation analysis technique to the determination of major and trace constituents in foods. (M.C.G.)

20338 A HIGH-RESOLUTION AUTORADIOGRAPHIC APPOSITION METHOD FOR WATER-SOLUBLE TRACERS AND TISSUE CONSTITUENTS. J. Novek (Karolinska Sjukhuset, Stockholm). Intern. J. Appl. Radiation and Isotopes, 13: 187-90(Apr. 1962). (In English)

A high-resolution autoradiographic apposition method which permits the study of the distribution of water-soluble tracers in histologic sections the staining of which at some stage calls for protection against water is described. Realignment of these specimen with the autoradiogram is carried out by fitting the contours of the control tags to their images projected with roentgen radiation in the nuclear track emulsion. The size of the contrast transition zone of the contours in these images is about 3 μ, which permits very accurate realignment. Specimens lie in maximal contact with the photographic emulsion. The method, which is attended by small losses of autoradiograms, permits the use of a modern cryostat so that, for instance, 5 μ-thick frozen sections with a diameter of 1.5–2 cm can be studied autoradiographically. (auth)

20339 MASS SPECTROMETRY OF THE HO_2 FREE RADICAL. S. N. Foner and R. L. Hudson (Johns Hopkins Univ., Silver Spring, Md.). J. Chem. Phys., 36: 2681-8 (May 15, 1962).

Mass spectrometric studies on the production, identification, and determination of thermochemical energies of HO_2 radicals are reported. Reactions found to produce HO_2 radicals, and examined in some detail, were: reaction of H with O_2, reaction of H with H_2O_2, reaction of O with H_2O_2, reaction of OH with H_2O_2, photolysis of H_2O_2, and low-power electrical discharge in H_2O_2. Of the reactions studied, the low-power electrical discharge in H_2O_2 provided the most intense and convenient source of HO_2 radicals. Ion-molecule reactions, which are negligible in normal operation of the mass spectrometer used for the study, are shown to be a potentially serious source of interference in studies of HO_2 with conventional mass spectrometers. The ionization potential of HO_2, I(HO)$_2$, and the appearance potential of HO_2^+ from H_2O_2, A(HO_2^+), were redetermined, and the bond dissociation energies D(H–OOH) and D(H–O_2) were recalculated. The measured values are: I(HO_2) = 11.53 ± 0.02 ev, A(HO_2^+) = 15.36 ± 0.05 ev with an estimated absolute accuracy of ±0.1 ev. The derived thermochemical energies are: D_0(H–OOH) = 88.4 ± 2 kcal/mole, D_0(H–O_2) = 45.9 ± 2 kcal/mole, $\Delta H_0^0(HO_2)$ = 5.7 ± 2 kcal/mole for the values at 0°K; and D(H–OOH) = 89.6 ± 2 kcal/mole, D(H–O_2) = 47.1 ± 2 kcal/mole, $\Delta H_{298}^0(H-O_2)$ = 5.0 ± 2 kcal/mole for the corresponding values at 25°C. Possible sources of error are examined and their effect on these values is discussed. (auth)

20340 SEPARATION OF THE ELEMENTS ACTINIUM TO AMERICIUM BY PAPER CHROMATOGRAPHY. C. Keller (Technische Hochschule, Karlsruhe and Institut fur Radiochemie, Kernforschungszentrum, Karlsruhe, Ger.). J. Chromatog., 7: 535-51(Apr. 1962). (In German)

A separation of the elements actinium to americium (atomic numbers 89 to 95) by paper chromatography is described. Alcohol–acid mixtures of various concentrations are used as eluents. In order to determine the position of the ions on the paper chromatograms, assay, autoradiographic and colorimetric techniques are used. The valency of plutonium and neptunium deposited on the paper chromatogram is determined after separation by co-precipitation reactions. The influence of the acidity of the eluents on the separation of the elements actinium–thorium–plutonium and americium is investigated more closely. With methanol–hydrochloric acid as eluent the trivalent and the tetravalent actinide elements show a minimum R_F value at a 2:1 methanol:hydrochloric acid ratio. Pu^{239} was detected by paper chromatography in a uranium solution that had been irradiated and then stored for a considerable time. With thorium as an example it is shown that a quantity of substance exceeding 10^{-10} g per paper chromatogram is necessary for obtaining a constant R_F value. With a smaller amount of thorium the R_F value decreases. (auth)

20341 CHROMATOGRAPHY ON PAPER IMPREGNATED WITH ION-EXCHANGE RESINS. VI. THE ADSORPTION OF UO_2^{2+} AND Th(IV) ON RESIN PAPERS. M. Lederer and F. Rallo (Consiglio Nazionale delle Ricerche, Rome and Istituto di Chimica Generale ed Inorganica, Rome). J. Chromatog., 7: 552-6(Apr. 1962). (In English)

The range of ion-exchange resin papers now available permits study of the mechanism of adsorption on a resin by very simple means. By carrying out chromatography with several resin papers and cellulose paper it is possible to distinguish adsorption on the organic network, complex formation with sulfonic groups, and partition (in the case of organic solvents) from real cation and anion exchange. Examples taken from the literature on Th(IV) and UO_2^{2+} indicate that the above-mentioned side effects contribute considerably to the adsorption observed on ion-exchange resins. (auth)

20342 A PRACTICAL SUPPORT FOR ASCENDING AND DESCENDING PAPER CHROMATOGRAPHY.

Frank M. Ganis (Univ. of Rochester, N. Y.). J. Chromatog., 7: 573-6(Apr. 1962). (In English)

A single unit support, adaptable for use with all commercially available cylindrical chromatography jars, is described. The support is constructed of stainless steel and utilizes the expanding-collar principle. (M.C.G.)

20343 CHEMICAL ANALYSIS OF MONAZITE SAND. Fathi Habashi (Technische Hochschule, Vienna). Metallurgia, 65: 255-6(May 1962).

In the analysis of monazite sand concentrates, the uranium is separated from thorium and the rare earths by precipitating the latter as oxalates from sulfuric acid solution. The uranium is separated from the other elements by an ion exchange procedure prior to colorimetric or polarographic determination. Thorium is separated from the rare earths by the classical iodate method and weighed as oxide. The rare earths are determined by a difference method. (auth)

20344 DISTRIBUTION OF ARSENIC IN NAPOLEON'S HAIR. Hamilton Smith, Sten Forshufvud, and Anders Wassén (Univ. of Glasgow and Vasagaten 33, Goteborg). Nature, 194: 725-6(May 26, 1962).

Hair samples were obtained from a heirloom of Napoleonic hairs purportedly cut from Napoleon's head the night after he died by his valet. The longest hair, 13 cm long, was irradiated for 24 hr by a flux of 10^{12} thermal neutrons/cm^2/sec and counted. The activity distribution in the hair indicates that Napoleon was exposed intermittently to arsenic over a period of 4 months. The limitations of the activation analysis method are discussed. (D.L.C.)

20345 PRECISION OF THE DETERMINATION OF COPPER, ARSENIC AND ANTIMONY FROM A PHOTOPEAK DECAY CURVE OF A GAMMA SPECTRUM. Wanda Żmijewska (Inst. of Nuclear Research, Polish Academy of Sciences, Warsaw). Nukleonika, 7: 101-8(1962). (In English)

Trace amounts of Cu, As, and Sb in a mixture are determined by a neutron activation method from a photopeak decay curve of a gamma spectrum. A statistical evaluation of the precision of the method is given. (auth)

20346 IDENTIFICATION OF BORON ON SILICON SURFACE WITH ACTIVATION ANALYSIS. G. Busch (ETH, Zurich), H. Schade, A. Gobbi, and P. Marmier. Phys. and Chem. Solids, 23: 513-14(May 1962). (In German)

It is shown that the highly conductive ρ-type surface layer that forms on silicon heated in borosilicate glass vacuum systems is composed of boron. The boron is identified and its concentration within this layer is determined by radiochemical activation analysis. Agreement is found with the concentration deduced from electrical conductivity measurements. (auth)

20347 AUTOMATIC RADIOCHROMATOGRAPHIC ANALYSIS OF AMINO ACIDS AND THEIR CARBON-14 AND TRITIUM-LABELED DERIVATIVES. Eric Schram and Robert Lombaert (Université, Brussels). Protides Biol. Fluids, Proc. 9th Colloq., Brussels, Belg., 1961, 88-9(Publ. 1962). (In French)

An apparatus is described for continuous scintillometry of effluent from chromatography columns for the analysis of labeled metabolites. The measuring cell is a coiled tube of polyethylene with an internal diameter of 2 mm and filled with crystals of anthracene. Crystals of 100–200-mμ diameter are used for measuring tritium, and 200–400-μ crystals are used for C^{14} and S^{35}. Scintillation pulses are detected with 2 E.M.I. 9514 S photomultiplier tubes, giving efficiencies of 55% for C^{14} and 2% for H^3. Besides applications in metabolic studies, this apparatus is useful for evaluating the radiochemical purity of labeled compounds. (H.H.D.)

20348 AZO DYES AS REAGENTS FOR THE SPECTROPHOTOMETRIC DETERMINATION OF URANIUM(IV,VI) AND THORIUM IN SOLVENT MIXTURES. G. E. Janauer and J. Korkisch (Universität, Vienna). Talanta, 9: 427-38 (May 1962). (In German)

The application of a number of azo dyes of the Solochrome class for the spectrophotometric determination of quadri- and sexavalent uranium and thorium in hydrochloric acid–methanolic media is described. The methods developed make possible the accurate and rapid quantitative determination of microgram amounts of the elements. (auth)

20349 ON THE ANALYTICAL GROUPS FOR TITANIUM(IV) IN ORGANIC REAGENTS. L. Sommer (Purkyně-Univ., Brno). Talanta, 9: 439-47(May 1962). (In German)

The reactions of 18 useful reagents for Ti(IV) are reviewed. It appears that chromotropic acid is the most selective and is a sufficiently sensitive reagent at pH 0 to 1, in the presence of excess reagent. The influence of some ions can be suppressed following their reduction by ascorbic acid. From a consideration of analytical groups of donor atoms in organic analytical reagents and a critical evaluation of many organic compounds as reagents for Ti(IV), a universal analytical group for Ti(IV) is derived. (auth)

General Inorganic and Physical Chemistry

20350 (AGC-0423-01-3) RESEARCH AND DEVELOPMENT OF HIGH-TEMPERATURE-STABLE INORGANIC RESINS AND ELASTOMERS. Quarterly Report, January 1 through March 31, 1962. J. Feltzin and O. S. Schaeffler (Aerojet-General Corp., Azusa, Calif.). Apr. 30, 1962. Contract DA-04-495-ORD-3075. 13p.

The investigation on preparation of thermally stable flexible and elastic silicates was continued. Asbestos was treated by a combined process of acid leaching followed by alkali extraction resulting in a further decrease of the extraneous ions in the asbestos matrix. Treatment of asbestos in a bomb with minimal quantities of NaOH and subsequent reaction with $ZrOCl_2$ in arochlor did not materially change the asbestos. Increases in the molecular weight of the product derived from the reaction of a silicate with dimethyldichlorosilane were accomplished with both methyltrichlorosilane and methylvinyldichlorosilane. Samples of polymer prepared with each of these crosslinking agents were prepared for evaluation. Work on the preparation of a polymer from phenylmethyldichlorosilane and sodium orthosilicate was continued; a soft gum was prepared by an emulsion polymerization process. (auth)

20351 (ARL-191) THERMODYNAMIC PROPERTIES OF IONS AT HIGH TEMPERATURES. John W. Green, Duncan E. Poland, and John L. Margrave (Wisconsin. Univ., Madison). Dec. 1961. Contract AF 33(616)-6384. 312p.

Ideal gas thermodynamic functions have been calculated with an IBM 650 computer for the elementary gaseous ions of charges +1, +2, +3, and +4 at close temperature intervals up to 51,000°K. The calculations are based on the atomic energy level data tabulated by the National Bureau of Standards. (auth)

20352 (DC-59-3-200) PRELIMINARY NOTES ON THE POSSIBLE IMPORTANCE OF THE KINETICS OF THE WATER-GAS REACTION IN THE VAPOR PLATING OF ALUMINA. G. R. Van Houten (General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati). Mar. 23, 1959. Contract AT(11-1)-171. 8p.

An analysis is presented which indicates that the rate of formation of water vapor can be kept more uniform despite local changes in gas concentration if the proper starting gas compositions are selected and that the formation of water vapor can be depressed strongly (by control of CO content). This implies that if the main gas bulk can be kept cool enough and the boundary layer can be kept thin enough, formation of H_2O will occur primarily at or near the hot surface. Previous analyses show no inadequacies in the originally proposed experimental program. (auth)

20353 (EURAEC-241) APPLICATION OF TRANSIENT ELECTROCHEMICAL METHODS TO THE CHEMICAL ANALYSIS OF PRODUCTS OF INTEREST IN NUCLEAR CHEMISTRY. Quarterly Report No. 6, October 1 to December 31, 1961. (Brussels. Université). Jan. 1962. Work performed under United States–Euratom Joint Research and Development Program. Contract 018-60-76RDB. 6p.

Several final improvements were made in the measuring circuit of the chronopotentiometric apparatus. Check measurements effected on the simulator circuit showed that the accuracy on the balance tension was brought to better than 0.5 millivolts. The electronic transfer reaction $UO_2^{2+} + e \rightarrow UO_2^{+}$ was studied through an extensive range of current composition and density. This reaction can be considered as practically reversible, even for compositions where the deceleration effect of the double layer is rendered very important. Systematic studying of the influence of the medium on the speed of the dismutation reaction $2\ U^{5+} \rightarrow U^{6+} + U^{4+}$ was orientated toward the examination of the acceleratory effects shown by the ions SCN^- and SO_4^{2-}. In the case of the thiocyanate medium, the particular form of the kinetic current indicated the occurrence of specific adsorption effects. (auth)

20354 (HW-19771) GAS COMPOSITION FOR THE DIRECT HYDROFLUORINATION OF PLUTONIUM(III) OXALATE. J. F. Facer and W. L. Lyon (Hanford Works, Richland, Wash.). Dec. 26, 1950. Contract AT(45-1)-1350. 2p.

A summary is given of information on the effects of the $HF : O_2$ ratio on the direct hydrofluorination rate of Pu(III) oxalate. By hydrofluorinating with a gas containing 80% HF and 20% O_2 by volume, the required reaction time at 500°C was shortened from 2 to 1 hr. (J.R.D.)

20355 (IA-731) SOME THEORETICAL CONSIDERATIONS ON THE STABILITY OF MIXED COMPLEXES. I. MERCURY(II) HALIDES. Y. Marcus and I. Eliezer (Israel Atomic Energy Commission, Tel-Aviv). Mar. 1962. 17p.

At attempt was made to explain the stabilization of ternary (mixed ligand) complexes as compared with the parent binary complexes, by a theoretical treatment based on a "polarized ion" model. The expressions developed were applied to the mercury (II) halide ternary complexes. The values obtained agree fairly well with the experimental results available. (auth)

20356 (JUL-32-RC) EIN BEITRAG ZUR CHARAKTERISIERUNG DER KATIONENAUSTAUSCHER-EIGENSCHAFTEN GEEIGNETER ANORGANISCHER MATERIALIEN. (A Contribution to the Characterization of the Cation Exchanger Properties of Selected Inorganic Materials). Hans-Juergen Riedel (Kernforschungsanlage. Institut für Radiochemie, Jülich, Germany). Jan. 1962. 87p.

The exchange or reaction behavior of Na^+, K^+, Rb^+, Cs^+, Fr^+, Ca^{2+}, Sr^{2+}, Sc^{3+}, and Y^{3+} on synthetic zirconium phosphate, wolframate, and molybdate and Pelagic clay and glauconite was investigated in dependence on the hydrogen ion concentration. By characterization of the exchangers by the distribution and separation coefficients, new possibilities for the separation of various ion types were indicated. A new method for the separation of $Sr^{90}-Y^{90}$, which depends on a reversal effect of the $Sr^{90}-Y^{90}$ selectivity coefficients at a critical pH value of >2.5, was developed. The exchange properties of a synthetic ultramarine were studied with respect to Fr and the alkali elements. (J.S.R.)

20357 (NBS-C-488(Sect.3)) AN ULTRAVIOLET MULTIPLET TABLE. THE SPECTRA OF MOLYBDENUM, TECHNETIUM, RUTHENIUM, RHODIUM, PALLADIUM, SILVER, CADMIUM, INDIUM, TIN, ANTIMONY, TELLURIUM, IODINE, XENON, CESIUM, BARIUM, LANTHANUM, HAFNIUM, TANTALUM, TUNGSTEN, RHENIUM, OSMIUM, IRIDIUM, PLATINUM, GOLD, MERCURY, THALLIUM, LEAD, BISMUTH, POLONIUM, RADON, AND RADIUM. Charlotte E. Moore (National Bureau of Standards, Washington, D. C.). Apr. 6, 1962. 98p.

The leading multiplets of 78 spectra of 31 elements in the range from molybdenum through lanthanum (z = 42 to 57) and hafnium through radium (z = 72 to 88) are presented. (M.C.G.)

20358 (NBS-C-488(Sect.4)) AN ULTRAVIOLET MULTIPLET TABLE. FINDING LIST FOR SPECTRA OF THE ELEMENTS HYDROGEN TO NIOBIUM (Z = 1 TO 41). Charlotte E. Moore (National Bureau of Standards, Washington, D. C.). Apr. 6, 1962. 70p.

A finding list containing all lines entered in Sections 1 and 2 of the Ultraviolet Multiplet Table, arranged in order of increasing wavelengths and covering the elements hydrogen to niobium (Z = 1 to 41), is presented. (M.C.G.)

20359 (NP-11530) AUTOMATIC COMPUTATION OF LCAO-SCF MOLECULAR ORBITALS FOR NON-SATURATED COMPOUNDS. Technical Report No. 5. Gaston Berthier (RIAS. Div. of Martin Co., Baltimore). Jan. 1962. Contract Nonr 3471(00). 44p.

A program for the complete study of unsaturated molecules according to the method based on orbitals leading to a system of integrals for which the Pariser-Parr formalism is verified, but where the various elements are mathematically well defined in terms of actual atomic orbitals. The calculation involves several steps, (determination of electron repulsion integrals, introduction of the basis orbitals λ, attainment of self-consistency, and calculation of molecular orbitals and transitions), which were previously programmed separately. In its final form the program includes 5 subroutines. (M.C.G.)

20360 (NYO-10289) THE MECHANISM OF OXIDATION OF IRON AND COBALT IN CARBON MONOXIDE–CARBON DIOXIDE MIXTURES (thesis). Frederick S. Pettit (Yale Univ., New Haven). May 1962. 209p.

The oxidation of iron and cobalt in carbon monoxide–carbon dioxide mixtures was studied in the temperature ranges 700 to 1100°C and 920 to 1200°C, respectively. The kinetics of oxidation were determined through use of an automatic recording vacuum balance. The mechanism of oxidation was ascertained through the analysis of kinetics and by marker studies, x-ray analysis and metallographic examination of oxidized specimens. The oxidation kinetics of iron were linear for oxide thicknesses less than 2×10^{-2} cm and parabolic for larger oxide thicknesses. The linear oxidation rate was found to be a linear function of the mole fraction of CO_2 in the gas phase and the sum of the partial

pressures of CO and CO_2 between 0.4 and 1.0 atmosphere pressure. These data confirmed the rate-determining step for the linear kinetics to be the dissociation of carbon dioxide into carbon monoxide and adsorbed oxygen atoms or ions in accordance with a mechanism proposed by C. Wagner. Linear kinetics were eventually replaced by parabolic kinetics because the rate of diffusion of iron ions across the oxide became slower than the rate of dissociation and adsorption of the gas phase. The oxidation kinetics of cobalt were linear for oxide thicknesses less than 7×10^{-4} cm and parabolic for larger oxide thicknesses. The linear oxidation rate, for oxide thicknesses between 4×10^{-6} and 7.3×10^{-5} cm was found to be a linear function of the mole fraction of CO_2 in the gas phase for temperatures between 1000 to 1200°C and 1 atm pressure. These data are in accordance with the mechanism proposed by C. Wagner. Parabolic kinetics were observed at oxide thicknesses greater than 7×10^{-4} cm since diffusion of cobalt ions across the oxide becomes slower than the phase boundary reaction. Oxygen ion diffusion was found not to occur in the oxidation of cobalt. The linear kinetics which are observed for the oxidation of iron in $CO-CO_2$ mixtures, were found to be dependent upon the size and orientation of grains in the oxide. For thin oxides, the size and orientation of oxide grains were controlled by the metal substrate. For thick oxides, a textured oxide surface was formed as a result of lateral growth of fast growing oxide grains. (auth)

20361 (TID-15788) APPLICATIONS OF ISOTOPES IN CHEMICAL KINETICS. Progress Report, September 1, 1961 to August 31, 1962. Gordon M. Harris (Buffalo, Univ.). June 1, 1962. Contract AT(30-1)-1578. 16p.

A report is given of research completed on kinetic studies of some isotopic exchange and other reactions, mainly of inorganic complex ions. (auth)

20362 (AEC-tr-4434) JOURNAL OF INORGANIC CHEMISTRY. Translation of Index to Zhurnal Neorganicheskoi Khimii, 2: Nos. 1-12, 1957. 89p. (PST-Cat.-89a).

20363 (NP-tr-893) CERIUM OXIDES. V. HIGH TEMPERATURE X-RAY EXAMINATION OF CERIUM OXIDES. G. Brauer and K. A. Gingerich. Translated by L. Rowe (U.K.A.E.A. Atomic Energy Research Establishment, Harwell, Berks, Eng.) from J. Inorg. & Nuclear Chem., 16: 87-99(1960). 32p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 15, abstract no. 10796.

20364 (AEC-tr-4457) JOURNAL OF INORGANIC CHEMISTRY. Translation of Zhurnal Neorganicheskoi Khimii, 3: No. 9, 1993-2222(1958). 323p. (PST-Cat.-379).

A total of 37 papers is included, two of which were previously abstracted in NSA. Separate abstracts were prepared for nine papers. Papers not abstracted are concerned with the chemistry of tellurites, acidity measurement, Pt compounds, stability of Mg, Ca, Sr, and Ba complexes, chemistry of ferric phosphates, reduction of selenious acid, chemistry of polythionic acids, chemistry of Sb, HNO_3 extraction, synthesis of rubidium aluminosilicate, electric conductivity of oxides, properties of various inorganic systems, behavior of Se in Te distillation, reactions of Rh, properties of Fe-C systems, and behavior of Na^+ in complex molecules. (J.R.D.)

20365 (AEC-tr-4457(p.1-9)) THE RELATIONSHIP BETWEEN THE RADIUS OF AN UNDEFORMED "GASEOUS" ION, AND CERTAIN PHYSICOCHEMICAL IONIC PROPERTIES. K. S. Krasnov. Translated from Zhur. Neorg. Khim., 3: 1993-8(1958).

Information and data are presented to show that a functional relation exists between γ_0, the radius of an ideal undeformed "gaseous" (as opposed to ionic radii in crystals) ions and various physiochemical ionic constants. The existence of this relation confirms that γ_0 is in agreement with a definite physical meaning of the ideal undeformed "gaseous" ion concept. On the basis of this relation, γ_{0Fr^+}, the radius of an undeformed gaseous Fr ion, and its crystallochemical radius were calculated along with internuclear distances in molecules of francium halides. (J.R.D.)

20366 (AEC-tr-4457(p.10-19)) THE PREPARATION AND PROPERTIES OF PLUTONIUM HALIDES. V. V. Fomin, N. A. Dmitrieva, and V. E. Reznikova. Translated from Zhur. Neorg. Khim., 3: 1999-2005(1958).

Preparation of Pu chlorides was investigated. It was found that when microquantities of thorium (UX_1) and Pu were chlorinated, the Pu sublimated in a stream of CCl_4 at a lower temperature than Th. Experiments are also described in which UO_2 and PuO_2 were chlorinated in CCl_4. Formation of a complex tetravalent Pu chloride was demonstrated in an experiment involving PuO_2 and RbCl heated in a CCl_4 stream. (J.R.D.)

20367 (AEC-tr-4457(p.69-79)) URANYL FERROCYANIDES. I. V. Tananaev and M. I. Levina. Translated from Zhur. Neorg. Khim., 3: 2045-52(1958).

Systems of the type $UO_2(NO_3)_2$-$M_4[Fe(CN)_6]$-H_2O were studied where M is Li, Na, K, Rb, or Cs. It was found that in systems with $Li_4[Fe(CN)_6]$ and $Na_4[Fe(CN)_6]$, $(UO_2)_2[Fe(CN)_6]$ is formed, while in the systems with $M_4[Fe(CN)_6]$ (M = K, Rb, or Cs), solid phases of the type $M_4(UO_2)_4[Fe(CN)_6]$ are formed, and as an intermediate solid phase, $M_2(UO_2)_3[Fe(CN)_6]_2$. In systems with $K_4[Fe(CN)_6]$ in presence of excess $[Fe(CN)_6]^{4-}$ and K^+ (6 to 8% K_2SO_4) ions, $K_{12}(UO_2)_6[Fe(CN)_6]_7$ is also formed. (J.R.D.)

20368 (AEC-tr-4457(p.98-107)) II. THE DETERMINATION OF THE COMPOSITION OF THE PRECIPITATES FORMED BY THE REACTION OF URANYL SALTS WITH SODIUM HYDROXIDE. V. I. Paramonova, M. D. Morachevskaya, and B. P. Nikol'skii. Translated from Zhur. Neorg. Khim., 3: 2067-74(1958).

Experiments were conducted in which varying quantities of known-strength NaOH were added to equal volumes of uranyl nitrate solutions. It was found that at room temperature these solutions reach equilibrium very slowly. Precipitates were formed in the system $UO_2(NO_3)_2$-NaOH-$NaNO_3$-H_2O depending on the Na and H ion concentrations. It is concluded that in the course of the interactions aqueous uranyl salts and NaOH may be determined by potentiometric titrations and by determining precipitate compositions. (J.R.D.)

20369 (AEC-tr-4457(p.161-6)) EXTRACTION OF PLUTONIUM(IV) WITH TRIBUTYL PHOSPHATE. V. V. Fomin, E. P. Maiorova, M. I. Krapivin, and V. G. Yudina. Translated from Zhur. Neorg. Khim., 3: 2113-16(1958).

Data are presented to show that the deviation of the distribution coefficient logarithm of tetravalent Pu from linear variation with the logarithm of TBP, when all conditions are constant, is caused by the presence of inextractable Am. (J.R.D.)

20370 (AEC-tr-4457(p.167-82)) DETERMINATION OF THE STABILITY CONSTANTS OF $Ce(NO_3)_x^{3-x}$ IONS BY EXTRACTION WITH TRIBUTYL PHOSPHATE. V. V. Fomin, R. E. Kartushova, and T. I. Rudenko. Translated from Zhur. Neorg. Khim., 3: 2117-27(1958).

The dependence of trivalent Ce distribution between aqueous nitric acid and tributyl phosphate in benzene on the concentrations of Ce, H ions, TBP, and nitrate ions

was investigated. The composition and stability constants of compounds existing in the aqueous and organic phases were established. (J.R.D.)

20371 (AEC-tr-4457(p.187-9)) THE DEPENDENCE OF THE ION EXCHANGE SEPARATION OF RARE-EARTH ELEMENTS ON THE STRUCTURAL RIGIDITY AND THE EXCHANGE CAPACITY OF RESINS. B. K. Preobrazhenskii, O. M. Lilova, A. V. Kalyamin, and A. B. Pashkov. Translated from Zhur. Neorg. Khim., 3: 2131-2(1958).

An investigation is reported concerning the effects of structural rigidity (number of cross links in the resin) and the exchange capacity of the resin on separation efficiency. Sulfonated polystyrene cation exchangers of the type KU-2 with various percentages of divinyl benzene were used. Results indicate that when a selective complex forming agent is used the coefficients of separation of rare-earth traces depend on the volumetric capacity of the resin. (J.R.D.)

20372 (AEC-tr-4457(p.197-204)) PHASE DIAGRAM OF ALLOYS OF THE SYSTEM MAGNESIUM–NEODYMIUM. E. M. Savitskii, V. F. Terekhova, and I. A. Novikova. Translated from Zhur. Neorg. Khim., 3: 2138-42(1958).

Investigations are reported which show that phases of Mg–Nd alloys in the range up to 30% Nd belong in the family of eutectic diagrams. (J.R.D.)

20373 (AEC-tr-4457(p.281-93)) THE MECHANISM OF MIGRATION OF RADIOACTIVE ISOTOPES PRODUCED IN α-DECAY. V. I. Baranov, A. M. Babeshkin, and K. B. Zaborenko. Translated from Zhur. Neorg. Khim., 3: 2200-9(1958).

This paper was previously abstracted from a French translation (CEA-tr-R-620) and appears in NSA, Vol. 13, abstract no. 12519.

20374 (AEC-tr-4457(p.294-8)) PREPARATION OF METALLIC CESIUM FROM CESIUM FLUORIDE. N. N. Zhuravlev. Translated from Zhur. Neorg. Khim., 3: 2210-11(1958).

Results of a study are presented concerning reduction of CsF to pure metal in vacuo at high temperatures. (J.R.D.)

20375 (AEC-tr-5100) DETONATION OF MIXED EXPLOSIVE SUBSTANCES. I. M. Voskoboinikov and G. S. Sosnova. Translated by Helen J. Chick and Charles L. Mader (Los Alamos Scientific Lab., N. Mex.) from Zhur. Prikład. Mekhan. i Tekh. Fiz., No. 4, 133-5(1961). 8p.

Results of a study are presented concerning the effect of chemical structure and the dispersion of the components in mixed explosives on the composition of detonation products in detonation wave fronts. (J.R.D.)

20376 (AEC-tr-5110) THE LUMINESCENCE OF CRYSTALLINE SUBSTANCES. V. L. Levshin. Translated from Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., 9: 355-68(1945). 24p.

Experimental data were analyzed in order to sketch the probable outlines of the luminescence process in solid crystalline bodies. The differences in luminescence by discrete centers and crystalline luminescence are described. The properties of luminescence from various types of materials are discussed. In the mechanism proposed for crystalline luminescence, the existence of 3 types of short-lived radiation (discrete center radiation, recombination of electrons without adhesion, and fluorescence with absorption in the base material) was assumed. A mechanism is described for these three types of radiation. (M.C.G.)

20377 (AEC-tr-5111) ACID DECOMPOSITION OF IRON CARBIDE. Rudolf Schenck and Robert Stenkhoff. Translated by L. M. Ferris (Oak Ridge National Lab., Tenn.) from Z. anorg. u. allgem. Chem., 161: 287-303 (1927). 19p.

A review of work on the mechanism of iron carbide acid decomposition is given. (J.R.D.)

20378 (AEC-tr-5112) THE LUMINESCENCE OF SOLUTIONS OF SALTS OF THE RARE EARTHS. A. N. Zaidel. Translated by Cyrus Feldman (Oak Ridge National Lab., Tenn.) from Izvest. Akad. Nauk S.S.S.R., Ser. Fiz., 9: 329-34(1945). 9p.

The existence of quasi-linear spectra in absorption and emission of rare earths is discussed. The quasi-linear spectra in the solid phase are due to the particular structure of the electronic shells of the rare earth atoms. The 5s and 5p shells protect the 4f terms and make them comparatively insensitive to disturbances caused by the molecular fields present. Characteristics of the spectra are described. (M.C.G.)

20379 (UCRL-Trans-817) NITRIDES OF METALS OF THE FIRST SECONDARY GROUPS OF THE PERIODIC SYSTEM. Robert Juza and Harry Hahn. Translated by R. B. Mudge from Z. anorg. u. allgem. Chem., 244: 133-48(1940). 37p.

Energy relations of compounds judged from heats of formation and thermal decomposition are given. Behavior of the nitrides with acids and bases is also discussed along with their behavior in high-temperature gases. Discussion of density, magnetic susceptibility, and crystal structure are included. (J.R.D.)

20380 PRECISE LATTICE CONSTANTS OF GERMANIUM, ALUMINUM, GALLIUM ARSENIDE, URANIUM, SULPHUR, QUARTZ AND SAPPHIRE. Ann S. Cooper (Bell Telephone Labs., Inc., Murray Hill, N. J.). Acta Cryst., 15: 578-82(June 1962). (In English)

The lattice constants of germanium, aluminum gallium arsenide, α-uranium, orthorhombic sulfur, natural quartz, and synthetic sapphire were determined to six significant figures by a precision single crystal x-ray method. A comparison is made with previously determined values for these materials. (auth)

20381 PRELIMINARY OBSERVATIONS OF MIXED OXIDE COMPOUNDS CONTAINING BeO. L. A. Harris, R. A. Potter, and H. L. Yakel (Oak Ridge National Lab., Tenn.). Acta Cryst., 15: 615-16(June 1962). (In English)

In the course of a survey of phase formation in mixed oxide systems containing BeO, the compounds 2 CaO · 3 BeO, 2 SrO · 3 BeO, and Y_2O_3 · 2 BeO were synthesized and studied by optical and single-crystal x-ray diffraction methods. Results were reported previously for the calcium and yttrium compounds. (N.W.R.)

20382 ACID-INDUCED AROMATIC HYDROGEN EXCHANGE. II. DETERMINATION OF THE SOLUBILITY OF BENZENE AND TOLUENE IN AQUEOUS SULPHURIC ACID. INFLUENCE OF ISOTOPIC MASS OF HYDROGEN ON THE SOLUBILITY. Stig Olsson (Nobel Inst. of Chemistry, Stockholm). Arkiv Kemi, 15: 259-74(1960). (In English)

The solubility of benzene and toluene in 80.62 ± 0.08% by weight aqueous sulfuric acid at 25.0°C was determined. Special techniques were used in the determinations and calculations to eliminate the effect of high volatility of the hydrocarbons and that of side-reactions. The influence of the isotopic mass of hydrogen on the solubility was measured and results are discussed. The solubilities of toluene and toluene-4-d in 70.49 ± 0.04% by weight aqueous sulfuric acid were found to be the same within the experimental accuracy. (C.H.)

20383 ACID-INDUCED AROMATIC HYDROGEN EXCHANGE. IV. DETERMINATION OF THE EXCHANGE RATES OF DEUTERIUM AND TRITIUM AGAINST PROTIUM IN TRIOPHENE. KINETIC ISOTOPE EFFECT IN THE ISOTOPIC EXCHANGE. Boerje Oestman and Stig Olsson (Nobel Inst. of Chemistry, Stockholm). Arkiv Kemi, 15: 275-82(1960). (In English)

The exchange rates of deuterium and tritium in two different positions of thiophene against protium in 57.02 ± 0.09% by weight aqueous sulfuric acid at 24.6 ± 0.1°C have been determined in a heterogeneous system. The kinetic isotope effect for each position and the exchange rate ratio for each heavy isotope have been obtained from the specific exchange rate constants. (auth)

20384 ELECTROMETRIC STUDY ON THORIUM-ARSENITE SYSTEM AS A FUNCTION OF THE pH. Ram Sahai Saxena and G. P. Saxena (Government Coll., Kota, India). Bull. Chem. Soc. Japan, 35: 22-6(Jan. 1962). (In English)

The reaction between thorium nitrate and sodium(meta)-arsenite solutions at different pH values was studied by emf measurements, using bright platinum as an indicator involving potentiometric titrations between the electrode. The electrometric experiments gave definite evidence of the formation of three arsenite compounds having the molecular formulas, $ThO_2 \cdot 2As_2O_3$, $ThO_2 \cdot As_2O_3$, and $3ThO_2 \cdot 2As_2O_3$ at pH 9.85, 11.25, and 12.28, respectively. The proportion of ThO_2 increases with the concentration of alkali used in the preparation of alkali arsenites and the formation of thorium arsenites is thus a function of the hydrogen ion concentration. The potentiometric titration curves are regular in form. The effects of alcohol and electrolytes on the end-point were studied, and the behavior of the indicator electrode and the mechanism of the electrode reaction are discussed. (P.C.H.)

20385 THE FORMATION OF SOME ALKALINE AND ALKALINE EARTH URANATES IN AQUEOUS MEDIA. André Chambionnat (Recherches Chimiques, Casablanca, Africa). Compt. rend., 254: 2345-7(Mar. 26, 1962). (In French)

The products formed by the cold reaction of hydroxide solutions of calcium, lithium, sodium, and potassium with uranyl salts in solution were studied by potentiometry, conductimetry, and chemical analysis. The results show, in the order of increasing saturation by the bases, a hexanuclear complex of uranium, a hexanuclear uranate, and a diuranate. The line also produces, under the same conditions, the uranate $Ca(UO_2)O_2$. (tr-auth)

20386 THE ANOMALOUS DISPERSION OF DOUBLE REFRACTION IN EUROPIUM CHLORIDE HEXAHYDRATE. N. K. Bel'skii (Inst. of Metallorganic Compounds, Academy of Sciences, USSR). Doklady Akad. S.S.S.R., 143: 1313-16 (Apr. 21, 1962). (In Russian)

By studying the double refraction of a strongly polarized absorption line in a crystal, the same data can be obtained as in studying the anomalous dispersion in a gas or liquid. The refractive indices were measured on a unit in which two compensating quartz wedges are used. The two refractive indices of the sample are related by the equation: $\mu_1 = \mu_2 + (\Delta n\lambda)/h'$. Here μ_1 and μ_2 are the two refractive indices, λ is the wavelength of the light, and h' is the thickness of the sample. The spectrum of $EuCl_3 \cdot 6H_2O$ with anomalous dispersion on the 17,259.6 cm^{-1} line ($^7F_0 \rightarrow {}^5D_0$) was taken. The difference in the refractive indices $(\mu_1 - \mu_2)$ close to and far from the absorption band is plotted as a function of the frequency. The half-width $\nu_{max} - \nu_{min}$ of the frequency was found to be 6 cm^{-1}, and $(\mu_{max} - \mu_{min}) = 6.3 \times 10^{-5}$. (TTT)

20387 THE SYNTHESIS AND FUNCTIONAL ANALYSIS OF OXYGENATED COMPLEXES ON THE SURFACE OF FRESHLY-CLEAVED GRAPHITE. Yu. A. Zarif'yants, V. F. Kiselev, N. N. Lezhnev, I. S. Novikova, and G. G. Fedorov (Moscow Univ. and Scientific Inst. of Rubber Tire Industry, USSR). Doklady Akad. Nauk S.S.S.R., 143: 1358-61(Apr. 21, 1952). (In Russian)

Finely-dispersed, natural graphite with a surface area of 380 m^2/g was found to adsorb irreversibly 4.1 μ-mole/m^2 of oxygen. After outgassing the graphite in vacuum and treating with water vapor, it was found that the graphite adsorbed 0.4 μ-mole/m^2 of water irreversibly. The graphite samples were then subjected to chemical analyses. It was found that the graphite contained 0.96 μ-equiv/m^2 of carboxyl groups, 0.16 μ-equiv/m^2 of acid hydroxy groups, 0.08 μ-equiv/m^2 of peroxy groups, and 0.07 μ-equiv/m^2 of carbonyl groups. The oxygen in these groups is 29% of the total amount of oxygen adsorbed irreversibly by the graphite. The excess adsorption centers may be due to natural hydroxyl groups, oxygen-containing radicals, and oxygen molecules bound to the graphite surface. (TTT)

20388 SOLID SOLUTIONS OF SODIUM AND POTASSIUM HYDRIDES IN THE HYDROXIDE. V. I. Mikheeva and M. M. Shkrabkina (Kurnakov Inst. of General and Inorganic Chemistry, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R., 143: 1362-3(Apr. 21, 1962). (In Russian)

Thermal analysis and x-ray analysis were used to investigate the phase diagram for NaH–NaOH mixtures at elevated temperatures. The initial materials were prepared by directly hydriding sodium and potassium metals, and by dehydrating NaOH and KOH at 500°C. It was found that the NaH–NaOH system holds about 60% NaH, and that the KH–KOH system holds about 48% KH. There is rapid thermal decomposition at higher hydride contents. Solid solutions containing a lower hydride content are stable at 600 to 650°C. The hydride does not react with the hydroxide up to 600°C, but breaks down by thermal decomposition with the evolution of H_2: $2MeH = 2Me + H_2$. The hydroxide stabilizes the decomposition of the hydride. For example, a solution containing 18.5% NaH retained 12.4% NaH after heating to 530°C, and a solution containing 20% KH had 17% KH left. The pure hydrides decomposed at 421 and 428°C, respectively. Thus, a solution of the hydride in the hydroxide can be used as a reductant for refractory compounds. (TTT)

20389 HETEROTRIPOLYHALIDES OF CLOSELY-RELATED ALKALI METALS AND THEIR SIGNIFICANCE IN THE PREPARATION OF PURE CESIUM AND RUBIDIUM COMPOUNDS. V. E. Plyushchev, S. B. Stepina, B. D. Stepin, and L. I. Lepeshkova (Moscow Univ.). Doklady Akad. Nauk S.S.S.R., 143: 1364-7(Apr. 21, 1962). (In Russian)

The relative polarization or deformability of K = 0.87, Rb = 1.87, and Cs = 2.79. Thus, the trihalides can be used to effect separations between K, Rb, and Cs, even though the ionic radii of these alkali elements are almost equal. The compounds of a series containing iodine such as CsI_3, $CsBrI_2$, $CsBr_2I$, $CsClBrI$, and $CsCl_2I$ are generally more stable than those of the series containing bromine such as $CsBr_3$, $CsClBr_2$, and $CsCl_2Br$. The Cs compounds are more stable than the K or Rb compounds. Thus, the Rb(IClBr) compound is used to purify Rb from K. The content of K in a RbCl salt containing 2 to 3% potassium was reduced to 0.0002% K by this method. Precipitation of $CsBrI_2$ from an aqueous alcoholic solution was similarly used to reduce the Rb content of the initial salt from 5.0% to 0.02% Rb. The process is simple and selective. (TTT)

20390 RESEARCH KEYNOTES ADVANCES IN ION EXCHANGE. Ind. Eng. Chem., 54: 49-55(July 1962).

Advances in ion exchange applications and development are discussed. Uses in water conditioning, inorganic chemistry and hydrometallurgy, organic chemistry, food technology, biochemistry, waste treatment, and catalysis are reviewed. Ion exchange materials and equipment development is also referred to. An extensive bibliography is included. (M.C.G.)

20391 AN ANALYTICAL APPROACH TO PLASMA TORCH CHEMISTRY. John E. Anderson and Laura K. Case (Speedway Labs., Linde Co., Indianapolis). Ind. Eng. Chem., Process Design Develop., 1: 161-5(July 1962).

Available thermodynamic and kinetic data were applied to predict quantitatively the over-all results that are obtained when hot hydrogen from the plasma torch is mixed with methane and the mixture is subsequently quenched. The results of the analytical treatment were compared to experimental data and the agreement was very good. A better understanding of the critical variables in this high temperature process was obtained from the analysis. (auth)

20392 THE PRODUCTION OF CYANOGEN FROM THE ELEMENTS, USING A PLASMA JET. Hans W. Leutner (Temple Univ., Philadelphia). Ind. Eng. Chem., Process Design Develop., 1: 166-8(July 1962).

The production of cyanogen under practicable conditions for limited industrial application with yields up to 15%, based on the carbon input, from a consumable carbon cathode with nitrogen and argon as plasma gases, is described. A systematic study of the use of ordinary and pyrolitic graphite as electrode materials is presented. (auth)

20393 PHASE RELATIONS AND CRYSTAL CHEMISTRY IN THE SYSTEM URANIUM OXIDE–LANTHANUM OXIDE. David C. Hill (Argonne National Lab., Ill.). J. Am. Ceram. Soc., 45: 258-63(June 1962).

Uranium oxide-lanthanum oxide compositions were investigated to determine the phase relations and crystal chemistry in the system under a variety of experimental conditions. X-ray diffraction, polished-section, and chemical analysis techniques were used as tools of investigation. Compositions of known metal atom concentration were subjected to oxygen, air, hydrogen, and vacuum environments at elevated temperatures. The dependence of lattice parameter on a stoichiometry for a $U_{0.5}La_{0.5}O_{1.75+x}$ composition was determined. Cubic fluorite solubility was found over a considerable portion of the system uranium oxide–lanthanum oxide. Results of lattice parameter measurements, stoichiometry determinations, and microstructure examinations are also presented. (auth)

20394 STABILITY OF SOLID PHASES IN THE TERNARY SYSTEMS OF SILICON AND CARBON WITH RHENIUM AND THE SIX PLATINUM METALS. Alan W. Searcy and Lies N. Finnie (Univ. of California, Berkeley). J. Am. Ceram. Soc., 45: 268-73(June 1962).

Possible reactions in the ternary systems of carbon and silicon with rhenium, ruthenium, rhodium, osmium, and iridium were studied at 1600°, 1340°, 1170°, 1350°, and 1340°C, respectively. At these temperatures the only stable phases are solid metal silicides and silicon carbide. Approximate ternary diagrams are fixed for the systems carbon–silicon–palladium and carbon–silicon–platinum by examination of phases formed during cooling above the liquidus temperatures. Lower limits to the thermodynamic stability of many of the metal silicides are set by the stability of these phases relative to reaction with carbon to form silicon carbide. Higher limits to the stability of the other metal silicides are set by their instability relative to reaction with carbon to form silicon carbide. These limits are used to estimate heats of formation for the platinum-family metal silicides. Measured and estimated heats of formation of other transition metal silicides are tabulated. (auth)

20395 NOTE ON DIFFUSION OF COBALT OXIDE AND FERROUS OXIDE IN POLYCRYSTALLINE MAGNESIUM OXIDE. Robert Shelley, E. Bertrand Rigby, and Ivan B. Cutler (Univ. of Utah, Salt Lake City). J. Am. Ceram. Soc., 45: 302-3(June 1962).

Polycrystalline MgO of 98% of theoretical density, 50 μ in grain size, and 99.99% pure was cut into bars 0.3 by 0.3 by 2.0 cm. FeO in fine-powder form was tightly packed around each MgO bar. The specimens were placed in an electrical resistance furnace at 1100°C for 25 hours in a controlled atmosphere of hydrogen and water vapor, ensuring the stability of FeO. A sharp, straight boundary was observed between the diffused and nondiffused part of the MgO bar. There was no evidence of grain-boundary diffusion but only of bulk diffusion similar to the diffusion observed with single crystals and at a rate comparable with single crystals. The diffusion process appeared to take place by a counterdiffusion of the cations through a relatively rigid oxygen lattice. Because of the nonstoichiometric property of FeO, cation vacancies were present. The diffusion process appeared to prefer bulk movement by means of vacancies over grain-boundary diffusion. Cobalt oxide was also packed around the polycrystalline MgO in the same manner as with FeO. The specimens were placed in a gas furnace open to the atmosphere for 25 hours at 1600°C. Results showed a straight boundary indicating only bulk diffusion and no grain-boundary diffusion. (N.W.R.)

20396 THE STRUCTURE OF U_2N_3. P. E. Evans. J. Am. Ceram. Soc., 45: 305(June 1962).

The structure of U_2N_3 was described by Rundle et al. as body-centered cubic (Mn_2O_3 type) with a lattice parameter of 10.678 A. Vaughan, on the other hand, found a hexagonal structure (La_2O_3 type) with a = 3.69 A and c = 5.83 A. The significant difference in the two investigations was in the methods by which the compounds were prepared. The U_2N_3 examined by Rundle and co-workers was prepared as a powder (by treating UN with excess nitrogen). That investigated by Vaughan occurred as an intermediate layer between UN_2 and UN formed on the surface of a massive uranium bar by reaction with nitrogen. It is suggested that the hexagonal form of U_2N_3 is in fact what may be termed a coherency structure, akin to epitaxial growth, dictated by the structure of the outermost nitride layer, UN_2. Although no orientation relations were reported for a layered sequence of the nitrides UN_2, U_2N_3, and UN there would be a very good match if (0001) and $[2\bar{1}\,\bar{1}0]$ of the hexagonal U_2N_3 were parallel to (111) and $[1\bar{1}0]$, respectively, of the UN_2. Rundle et al. measured the lattice parameter of UN_2 and found it to be 5.310 A. The corresponding spacing along $[1\bar{1}0]$ is therefore 3.755 A. The value of a (3.69 A) quoted by Vaughan thus represents a mismatch of only −1.7% in terms of the UN_2 $[1\bar{1}0]$ spacing, along $[2\bar{1}\,\bar{1}0]$ in U_2N_3. (N.W.R.)

20397 THE NATURE OF THE ELECTROPHILIC DEUTERIUM EXCHANGE REACTION OF DECABORANE WITH DEUTERIUM CHLORIDE. John A. Dupont and M. Frederick Hawthorne (Redstone Arsenal, Huntsville, Ala.). J. Am. Chem. Soc., 84: 1804-8(May 20, 1962).

Treatment of decaborane with deuterium chloride in carbon disulfide solution and in the presence of aluminum chloride results in deuterium proton exchange at the 1, 2, 3, and 4 positions of decaborane. Deuterium chloride in dioxane solution is a useful reagent for the preparation of

bridge and 5, 6, 7, 8, 9, and 10-d_{10} decaborane. The aluminum chloride-catalyzed exchange reaction proceeds in such a manner that the four entering deuterium atoms are kinetically indistinguishable. The mechanistic and preparative aspects of these observations are discussed. (auth)

20398 TEMPERATURE DEPENDENCE OF THE CARBON ISOTOPE EFFECT IN THE DEHYDRATION OF FORMIC ACID BY CONCENTRATED SULFURIC ACID. Jacob Bigeleisen, Ruby H. Haschemeyer, Max Wolfsberg, and Peter E. Yankwich (Brookhaven National Lab., Upton, N. Y. and Univ. of Illinois, Urbana). J. Am. Chem. Soc., 84: 1813-15(May 20, 1962).

The C^{13} kinetic isotope fractionation in the dehydration of formic acid by concentrated sulfuric acid was studied over the range −30.0 to 0.0°C. The observed temperature dependence was examined by the "gamma-bar" method of Bigeleisen and Wolfsberg (both with and without consideration of the effects of loss of bending frequencies) and by the "semi-empirical" method of Yankwich, Weber, and Ikeda. Calculated values of the temperature-independent factor in the isotopic rate constant ratio lie within 1% of unity; the calculated sums of the differences upon activation of the diagonal cartesian force constants correspond especially well with the value expected for C−O bond rupture when bending frequency losses are taken into account, being near 7 md.Å.$^{-1}$. (auth)

20399 THE QUESTION OF INTIMATE ION PAIRS. C. Gardner Swain and Gen-Ichi Tsuchihashi (Massachusetts Inst. of Tech., Cambridge). J. Am. Chem. Soc., 84: 2021-2 (May 20, 1962).

The existence of ion pairs in reactions of triphenylmethyl and benzhydryl and capturable intermediates in the rearrangements of these ion pairs are discussed. (M.C.G.)

20400 SOLUBILITY AND THE NATURE OF BONDING IN FUSED ALKALI HALIDE-METAL SYSTEMS. Kenneth S. Pitzer (Rice Univ., Houston, Tex.). J. Am. Chem. Soc., 84: 2025-8(June 5, 1962).

A solution of an alkali metal in a fused halide of the same metal is discussed in terms of the mixing of the two negative species, halide ions and F-center-like electrons in cavities, within the irregular lattice of positive ions. The positive energy of mixing is related to the excess energy of a hypothetical metal comprising an ionic lattice of F-centers and positive ions over that of the true metal. The theory predicts substantial positive excess entropies of mixing. The solubility data of Bredig and collaborators are shown to be consistent with this model and certain parameters are evaluated for each system. (auth)

20401 THE EXCHANGE OF DEUTERIUM WITH SOLID POTASSIUM HYDROBORATE. Robert E. Mesmer and William L. Jolly (Univ. of California, Berkeley). J. Am. Chem. Soc., 84: 2039-42(June 5, 1962).

Potassium deuterioborate was prepared by reaction of deuterium gas with potassium hydroborate at temperatures near 500°. It is proposed that both the exchange reaction and the pyrolysis proceed through the following initial dissociation: $BH_4^- \rightarrow H^- + \frac{1}{2}B_2H_6$. The proportions of the anions BH_4^-, BH_3D^-, $BH_2D_2^-$, BHD_3^-, and BD_4^- in partially deuteriated samples were deduced from the composition of the hydrogen evolved upon hydrolysis, from proton magnetic resonance spectra, and from the magnitude of the equilibrium constant for exchange. The proportions of these anions in partially deuteriated samples which have been equilibrated at ca. 500° correspond to a random distribution of deuterium atoms. (auth)

20402 A CALORIMETRIC STUDY OF THE REACTION OF RARE-EARTH IONS WITH EDTA IN AQUEOUS SOLUTION. J. L. Mackey, J. E. Powell, and F. H. Spedding (Ames Lab., Ames, Iowa). J. Am. Chem. Soc., 84: 2047-50(June 5, 1962).

The heats of reaction for the rare earths with EDTA in solution at 25° and $\mu = 0.1\underline{M}$ (KNO_3) were measured using a calorimetric method. The method was based on the replacement of one chelated metal ion by another and offers several advantages for studies of EDTA-like ligands. The thermodynamic quantities ΔF^0, ΔH^0, and ΔS^0 for the reaction of rare-earth ions with EDTA in $0.1\underline{M}$ KNO_3 are reported. These quantities indicate that the rare-earth chelates of EDTA fall into two series. Reasons for the existence of the two series were discussed, and it was suggested that a basic trend in ΔH^0 occurs in the rare-earth series, which is independent of the complexing or chelating ligand. (auth)

20403 ADSORPTION ON INORGANIC MATERIALS. IV. CATION EXCHANGE PROPERTIES OF ZIRCONIUM ANTIMONATE. Harold O. Phillips and Kurt A. Kraus (Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc., 84: 2267-8(June 5, 1962).

In a search for inorganic materials which might exhibit unique cation exchange properties, the solid resulting from co-precipitation of Zr(IV) and Sb(V) was found particularly attractive. Some preliminary rate studies with alkali metals indicated that the material behaves comparably to other inorganic ion exchangers of this type. Differences in selectivity of alkali metals were large. (M.C.G.)

20404 Fe^{57} MÖSSBAUER RESONANCE AND COMPARISON OF BONDING IN $C_5H_5Fe_2(CO)_6$ AND $C_5H_5Fe(CO)_2$. G. K. Wertheim and R. H. Herber (Bell Telephone Labs., Murray Hill, N. J. and Rutgers Univ., New Brunswick, N. J.). J. Am. Chem. Soc., 84: 2274-5(June 5, 1962).

$C_5H_5Fe(CO)_2$ and $C_5H_5Fe_2(CO)_6$ were used as thin absorbers in a Mössbauer resonance experiment using Co^{57} diffused into metallic chromium as a source. Both compounds showed essentially no resonant absorption at room temperature. At liquid nitrogen temperature, the resonance effect of a 0.25 mm absorber was on the order of 15 to 20%. Bonding in the two compounds was compared. (M.C.G.)

20405 HEAT OF FORMATION OF THE CN RADICAL. J. Berkowitz (Argonne National Lab., Ill.). J. Chem. Phys., 36: 2533-9(May 15, 1962).

The vapor in equilibrium with graphite and nitrogen in the temperature range 2200° to 2500°K was analyzed with a mass spectrometer. The partial pressure of CN radicals measured in this way was used to calculate $\Delta H_f^\circ(CN) = 109$ kcal/mole, equivalent to $D_0(CN) = 7.5 \pm 0.1_5$ ev. The results of a variety of experiments are compared with this one, and in some cases, reinterpreted. The appearance potential of CN^+ from CN was found to be 14.2 ± 0.3 ev. Other possible azocarbon species up to C_6N_6 were investigated and found to be much less abundant than CN. (auth)

20406 PRESSURE DEPENDENCE OF FLUORESCENCE SPECTRA. III. EFFECT OF FINITE PULSE LENGTH. Joseph W. Brauner and David J. Wilson (Univ. of Rochester, N. Y.). J. Chem. Phys., 36: 2547-8(May 15, 1962).

The effect of finite lengths of square exciting pulses in vibrational relaxation experiments in gases was investigated theoretically. Taking into account the finite duration of the pulse length did not yield results drastically different from those obtained assuming instantaneous excitation, provided that the exciting pulse has a width not more than about half the mean time between 1-to-0 transitions. (auth)

20407 ATTACHMENT OF LOW-ENERGY ELECTRONS TO OXYGEN. D. C. Conway (Purdue Univ., Lafayette, Ind.). J. Chem. Phys., 36: 2549-57(May 15, 1962).

The experimental data on electron attachment in pure O_2 and $C_2H_4-O_2$, CO_2-O_2, N_2-O_2, CH_4-O_2, and $He-O_2$ mixtures are reviewed. The results were interpreted by a mechanism which is a modification of the Hurst and Bortner extension of the Bloch and Bradbury mechanism. The rate constants in the general rate equation were estimated and the equation is shown to be in general agreement with the reaction orders which were obtained. The CO_2 and C_2H_4 data led to a value for the mean life of O_2^{-*} against electron detachment of 1×10^{-9} sec. The various reactions are discussed in some detail. The number of collisions required to stabilize O_2^{-*} was estimated from the experimental data and compared with the theoretical estimate of the rate of vibrational deactivation for each of the molecules studied. (auth)

20408 UNIMOLECULAR DECOMPOSITION OF VIBRATIONALLY EXCITED ETHANE AND ETHYL RADICALS. Carl A. Heller and Alvin S. Gordon (Naval Ordnance Test Station, Inyokern (China Lake), Calif.). J. Chem. Phys., 36: 2648-53 (May 15, 1962).

H or D atoms and ethyl radicals were concurrently produced by the mercury sensitized photolysis of mixtures of H_2 (or D_2) and diethyl ketone. Combination of an ethyl radical with a hydrogen atom produces vibrationally excited ethane molecules. Their rate of dissociation into methyl radicals relative to stabilization to ethane was studied as a function of pressure of ketone for both H and D. Similar studies were made of the mercury sensitized reactions of mixtures of D_2 or H_2 and ethylene, which permitted the measurement of the maximum rates of decomposition of excited ethyl radical and of excited ethane both as a function of pressure and of temperature. Results showed that vibrational energy is not used in overcoming the barrier for alkyl radical addition to an olefin bond. (auth)

20409 INFRARED-ABSORPTION SPECTRA OF LiOH AND LiOD. R. A. Buchanan, E. L. Kinsey, and H. H. Caspers (Univ. of California, Los Angeles). J. Chem. Phys., 36: 2665-75 (May 15, 1962).

Spectra of films of LiOH and LiOD in the region from 450 cm^{-1} (22 μ) to 4500 cm^{-1} (2.2 μ) are presented. Polarized spectra of crystals of LiOH, LiOD, and mixed crystals of LiOH and LiOD at room temperature and at 15°K are also presented. The OH^- ion stretching fundamental at 3678 cm^{-1} (2.7 μ) and the OD^- ion stretching fundamental at 2713 cm^{-1} (3.69 μ) are each bracketed by sidebands in a nearly symmetric manner. The sidebands on the low wave-number side of each fundamental, the difference sidebands, all vanish at 15°K, while the main features of the sidebands on the high wave-number side of each fundamental, the summation sidebands, are preserved at low temperatures. In addition, the increased resolution resulting from reduced bandwidths at low temperatures reveals several new summation sidebands not observed in the room-temperature spectrum. A correlation of the LiOH and LiOD summation sidebands is presented and the deuteration effects discussed. These effects are observed to be in very good agreement with the theory which assumes that the sidebands are the result of binary combinations of low-frequency lattice modes with those modes which involve the hydroxyl ion stretching motions. They are not, however, in agreement with the rotation theory which proposes that the sidebands of LiOH, $Mg(OH)_2$, and $Ca(OH)_2$ are the results of the coupling of localized rotations of the OH^- ions with their internal stretching frequency. An analysis of the mixed-crystal spectra reveals the significant role of hydroxide–hydroxide interactions in producing the observed intensities of the sidebands. (auth)

20410 IONIZATION AND DISSOCIATION OF HYDROGEN PEROXIDE BY ELECTRON IMPACT. S. N. Foner and R. L. Hudson (Johns Hopkins Univ., Silver Spring, Md.). J. Chem. Phys., 36: 2676-80 (May 15, 1962).

Mass spectrometric measurements on hydrogen peroxide were carried out with a modulated molecular beam sampling system to eliminate interferences from decomposition products. The mass spectrum of pure hydrogen peroxide differs considerably from previously reported spectra, which did not include an estimate of the H_2O^+ and O_2^+ ion intensities because of decomposition problems. Appearance potentials of the ions were measured with the following results: $I(H_2O_2) = 10.92 \pm 0.05$ ev, $A(HO_2^+) = 15.36 \pm 0.05$ ev, $A(O_2^+) = 15.8 \pm 0.5$ ev, $A(H_2O^+) = 14.09 \pm 0.10$ ev, $A(OH^+) = 15.35 \pm 0.10$ ev, and $A(O^+) = 17.0 \pm 1.0$ ev. The ionization processes and relevant thermochemical energies are discussed. It was found that the H_2O^+ and OH^+ ions are evolved without excess energy, while the dissociative processes producing O_2^+ and O^+ require excess energy. (auth)

20411 DISTORTION OF ATOMIC ORBITALS IN MOLECULAR ORBITALS. I. POLARIZATION OF THE HYDROGEN ATOM IN H_2^+. M. Geller (Northwestern Univ., Evanston, Ill.), A. A. Frost, and P. G. Lykos. J. Chem. Phys., 36: 2693-8 (May 15, 1962).

The Finklestein-Horowitz wave function for the ground state of the H_2^+ molecule ion leads to a potential energy function in qualitative agreement with experiment. The addition of p character into the atomic orbitals comprising the molecular wavefunction introduces polarization and leads to an improved estimate of the energy. The use of off-center orbitals to introduce polarization does not lead to significantly improved results, however. The different ways of allowing for charge shift in the atomic orbitals comprising the molecular orbital for the molecule ion and for the polarizability of the hydrogen atom in the presence of a weak electric field are discussed. (auth)

20412 PARAMAGNETIC RESONANCE OF NICKEL IONS IN DOUBLE-NITRATE CRYSTALS. J. W. Culvahouse (Univ. of Kansas, Lawrence). J. Chem. Phys., 36: 2720-6 (May 15, 1962).

It is shown that there are two paramagnetic complexes for divalent nickel ions in the double-nitrate crystals. One, which was not previously described, has a very large-zero field splitting: $D = 2.25 \pm 0.10$ cm^{-1} for 1% nickel in $La_2Zn_3(NO_3)_{12} \cdot 24H_2O$ at 77°K, and it is shown that this complex is due to ions in the same site as that which produces the more anisotropic cobalt spectrum—the Y-ion site. The interaction between cerium ions and nickel ions in the other divalent site—the X-ion site—is shown to be different from the interaction of cerium and cobalt in the same site. The origin of the difference is explained qualitatively. (auth)

20413 MÖSSBAUER SPECTRA OF SOME IRON COMPLEXES. L. M. Epstein (Westinghouse Electric Corp., East Pittsburgh, Penna.). J. Chem. Phys., 36: 2731-7 (May 15, 1962).

Mössbauer spectra were obtained for the following coordination compounds: iron phthalocyanine, ferrocene, iron carbonyl, iron III acetylacetonate, and iron II acetylacetonate dipyridine; for the following complex ion salts iron II trisphenanthroline chloride, iron III EDTA (monosodium salt), iron II EDTA, hemin, ferricium picrate, sodium nitroprusside, and some ferro- and ferricyanides. The isomer shift (relative to stainless steel) for iron II has the value expected for an inorganic ion only for iron II EDTA. In the other complexes the shifts are about 0.4 mm/sec, except ferrocyanide which is near zero. For iron III only

hemin and ferricyanide have unusually small isomer shifts. The large negative isomer shift in sodium nitroprusside suggests iron IV. Except for ferrocyanide quadrupole splittings occurred in iron of valence 0, II, and IV and were observed for both spin-paired and spin-unpaired complexes. Splittings varied widely, however not exceeding those for inorganic ferrous salts. Sodium ferricyanide showed an unexpected quadrupole splitting. Other iron III complexes gave broad and unsymmetrical spectra. (auth)

20414 TRANSPORT PROPERTIES OF POLAR-GAS MIXTURES. E. A. Mason (Univ. of Maryland, College Park) and L. Monchick. J. Chem. Phys., 36: 2746-57 (May 15, 1962).

A previously proposed model for the calculation of viscosity, diffusion, and thermal diffusion in dilute polar gases was extended to mixtures. A simple set of combination rules for the potential parameters is discussed. Available data limit the comparison of calculation and experiment to binary mixtures of a polar and a nonpolar gas. The agreement exhibits a success comparable to that obtained for models and combination rules involving only nonpolar gases. It is concluded that the model and combination rules can be used to describe the transport properties of mixtures with a fair measure of success, and that any attempts to refine the combination rules should await more experimental results of high accuracy, especially results on thermal diffusion and diffusion. (auth)

20415 THERMAL BLEACHING OF Cl_2^- CENTERS. Theodore J. Neubert and John A. Reffner (Illinois Inst. of Tech., Chicago). J. Chem. Phys., 36: 2780-2(May 15, 1962).

The kinetics of thermal bleaching of Cl_2^- centers in x-irradiated KCl-Pb were studied by measurement of the rate of disappearance of the 3650 Å optical absorption, at constant temperatures in the range 180 to 210°K. Thermal bleaching was second order in Cl_2^- concentration. A two-part mechanism is suggested: the first being a diffusion of Cl_2^- via hopping of the positive hole from point to point through the lattice, the second being the recombination of holes with electrons trapped at lead ions. The activation energy for Cl_2^- center bleaching in KCl-Pb is 0.53 ev. (auth)

20416 LATTICE FREQUENCIES AND ROTATIONAL BARRIERS FOR INORGANIC CARBONATES AND NITRATES. R. A. Schroeder (Univ. of Southwestern Louisiana, Lafayette), C. E. Weir, and E. R. Lippincott. J. Chem. Phys., 36: 2803-4(May 15, 1962).

Infrared absorption spectra of inorganic nitrates and carbonates were obtained on single crystals at temperatures between room temperature and liquid-helium temperature. Band limits observed in the spectra are interpreted as representing rotational energy barriers. The barrier heights are of the order of 200 cm^{-1} and depend on the crystal structure and the ions involved. Almost all of the bands are interpreted as summation bands of fundamental frequencies with successive levels of a liberating oscillator. The liberation is considered to represent a planar torsional oscillation of the anion about the trigonal axis. (M.C.G.)

20417 LINE SHAPE OF ULTRAVIOLET ABSORPTION IN CRYSTALLINE RARE GASES. Albert Gold and Robert S. Knox (Argonne National Lab., Ill.). J. Chem. Phys., 36: 2805-6(May 15, 1962).

Ultraviolet absorption in crystalline rare gases was studied. Interpretations of observed linewidths using conventional solid-state theory are suggested. It was concluded that the exciton in a solid rare gas is likely mobile and that phonon scattering accounts for the broadening. (M.C.G.)

20418 COMMENT ON THE CALCULATION OF RATE CONSTANTS FROM TRANSITION-STATE THEORY. Donald Rapp (Lockheed Missiles and Space Co., Palo Alto, Calif.) and Ralph E. Weston, Jr. J. Chem. Phys., 36: 2807-8(May 15, 1962). (BNL-5916)

In the transition state method of calculating reaction rate constants, a statistical factor was introduced by the rotational partition functions of the reactants and the activated complex. Corrections to this factor are discussed. The case of exchange reactions between hydrogen atoms and molecules is illustrated. (M.C.G.)

20419 ANALYSIS OF THE EPR SPECTRUM OF N,N'-TETRAMETHYLBENZIDINE POSITIVE ION. Z. Galus and Ralph N. Adams (Univ. of Kansas, Lawrence). J. Chem. Phys., 36: 2814(May 15, 1962).

The electron paramagnetic spectra of the N,N'-tetramethylbenzidine (TMB) positive ion were determined. The hyperfine pattern consists of 11 major groups each split into 6 lines. Crystal violet was deuterated and the corresponding ring-deuterated TMB prepared by chemical oxidation of the crystal violet. The deuterated TMB spectra confirmed that the major coupling is due to methyl protons. (M.C.G.)

20420 URANIUM(IV) PERCHLORATE. K. W. Bagnall, D. Brown, and A. M. Deane (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Chem. Soc., 1655-7(May 1962).

A uranium tetraperchlorate–dimethylacetamide complex, $U(ClO_4)_4.6Ac\cdot NMe_2$, and its trihydrate were prepared. The complex is stable, much more so than those formed by methylacetamide, which appear to have 6 and 8 molecules of ligand severally and are hygroscopic. Uranium tetraperchlorate is itself unstable and was not obtained pure. (auth)

20421 THE C ≡ N STRETCHING FREQUENCY IN METAL COMPLEXES OF 3-CYANOPENTANE-2,4-DIONE. John P. Fackler, Jr. (Univ. of California, Berkeley). J. Chem. Soc., 1957-60(May 1962).

The preparation of 3-cyanopentane-2,4-dione is described. The infrared stretching frequencies of the C ≡ N group in twelve metal complexes of this β-diketone are recorded. While marked variations in the position of the C ≡ N stretching frequency are found with changes in the co-ordination number of the metal ion, the position of the band is found at 2216.2 ± 1.0 cm^{-1} in six tervalent complexes. It appears that the $2p_\pi$-electrons of the chelate ring are not strongly perturbed by interaction with the 3d-orbitals of the metal. (auth)

20422 AMMINERUTHENIUM(III) PHOSPHATES. B. E. Mayer and J. E. Salmon (Battersea Coll. of Tech., London). J. Chem. Soc., 2018-20(May 1962).

A number of ammineruthenium(III) complex compounds containing phosphate were isolated and their compositions established by analysis, conductivity measurements, ion-exchange methods, and dehydration studies, as $[Ru(NH_3)_6]PO_4.2H_2O$, $[Ru(NH_3)_4PO_4].2H_2O$, $[Ru(NH_3)_4(H_2O)_2]PO_4$, $[Ru(NH_3)_5(OH)]HPO_4.H_2O$, and $[Ru(NH_3)_4(NO)(OH)]HPO_4.H_2O$. Attempts to introduce the phosphate group as ligand into the hexammine, pentammine, and triammine failed. Only one phosphatotetrammine complex was obtained and this had properties different from those of the isomeric diaquotetrammine phosphate. (auth)

20423 THE MAGNETIC PROPERTIES OF SOME HALIDES OF TITANIUM AND ZIRCONIUM. J. Lewis,

D. J. Machin, I. E. Newnham, and R. S. Nyholm (University Coll., London and Commonwealth Scientific and Industrial Research Organization, Melbourne). J. Chem. Soc., 2037-41(May 1962).

The magnetic properties of some compounds of tervalent and bivalent titanium and zirconium were measured in the temperature range 80–300°K. The ter- and bi-valent chlorides of titanium are antiferromagnetic with Neel points at 265 and 85°K, respectively. The reasons for the very low moments, about 0.5 B.M., observed for the chloride, bromide, and iodide of zirconium(III) and the chloride of zirconium(II) are discussed. The anomalous behavior of the susceptibility of titanium(III) chloride at low temperatures is also considered. The temperature dependence of susceptibility of hexaureatitanium(III) perchlorate and sodium tetrachlorotitanate(II) is reported. (auth)

20424 EQUILIBRIUM STUDIES IN THE REDUCTION OF THORIUM OXIDE BY ALUMINUM. Douglas O. Raleigh (Atomics International, Canoga Park, Calif.). J. Electrochem. Soc., 109: 521-5(June 1962).

Thorium–aluminum melts were equilibrated with a molten fluoride salt that was saturated with thoria and alumina and contained a solid excess of both. Under these conditions, the dissolved and solid oxides are in equilibrium. By determining the equilibrium concentration of thorium in aluminum in this system, it was shown that the primary driving force for the reaction is the free energy of formation of $ThAl_3$, which was estimated to be –36 kcal. The results indicate that intermetallic compound formation may play a useful role in promoting metallothermic reductions in a number of systems. (P.C.H.)

20425 AN INTERPRETATION OF SELF-DIFFUSION MEASUREMENTS OF CATIONS IN CLAY-WATER SYSTEMS. R. G. Gast (UT-AEC Agricultural Research Lab., Oak Ridge, Tenn.). J. Colloid Sci., 17: 492-500(June 1962).

Diffusivities of eight cations in bentonite clay pastes are determined and the results interpreted in the light of electrochemical and viscosity data. Evidence is presented that points toward the diffusivity of cations in the clay pastes as being a multiple-rate process. Results suggest that contributions of the diffuse layer and true-solution ions, and the Stern-layer ions, dominate the diffusion process. (auth)

20426 DIAGRAMMATIC REPRESENTATION OF THE THERMODYNAMICS OF METAL-FUSED CHLORIDE SYSTEMS. R. Littlewood (Tube Investments Research Labs., Saffron Walden, Essex, Eng.). J. Electrochem. Soc., 109: 525-34(June 1962).

Diagrams in which the equilibrium potential E (relative to the standard chlorine electrode) in the system is plotted against the activity of oxide ion in the chloride melt (expressed as its negative logarithm, pO^{2-}) are presented for the metals Mg, Ni, Zr, and Ti in contact with one or more of the chlorides LiCl, KCl, NaCl, and $MgCl_2$ at 800°C. As an example of the use of E-pO^{2-} diagrams, it is shown how they can be applied to metal extraction processes involving chlorides. The main advance is that the method offers an approach to the prediction of impurity levels and is applicable equally well to electrowinning from fused chlorides and to reduction of chlorides by base metals. Levels of impurity, particularly of oxygen, in the metal product are obtainable directly from the diagrams. (auth)

20427 SPECTROPHOTOMETRIC DETERMINATION OF THORIUM WITH RUTIN (QUERCETIN-3-RUTINOSIDE). Brahm Dev and B. D. Jain (Univ. of Delhi). J. Less-Common Metals, 4: 286-90(June 1962). (In English)

Rutin was used for the spectrophotometric determination of thorium. Thorium forms with this reagent a deep yellow water-soluble complex, which obeys Lambert–Beer's law at 4.35 mμ within the concentration range of 1.16–23.20 ppm of thorium. The color intensity of the complex does not vary between pH 3.0 and 4.0. The molar composition of the complex shows that it contains thorium and the rutin in the molar ratio of 1:2. The limits of interference due to various cations and anions in this determination are defined. (auth)

20428 THE INFRARED SPECTRUM OF CH_3SiH_3 AND CH_3SiD_3. R. E. Wilde (Univ. of Washington, Seattle). J. Mol. Spectroscopy, 8: 427-54(June 1962).

The low-resolution infrared spectra of methyl silane and methyl trideuterosilane are reported for the 450 to 10,000 cm^{-1} region. All the fundamental frequencies are assigned to normal modes, and tentative assignments are given to many of the overtone and combination bands. The analyses of two parallel- and four perpendicular-type bands of methyl silane and of one parallel- and one perpendicular-type band of methyl trideuterosilane are reported for the 2000 to 5000 cm^{-1} region. The combination difference-sum method of analysis is employed. In the case of the parallel bands, the rotational constants A', B", B', and D_J are reported. In the case of the perpendicular bands, values are reported for A', B', ζ_J, and D_K. The ground-state rotational constants A" and B" are obtainable from previous microwave studies. (auth)

20429 THE PROTON MAGNETIC RESONANCE SPECTRA OF $H_2C=C^{13}H_2$ AND $H_2C=CHD$. G. S. Reddy and J. H. Goldstein (Emory Univ., Atlanta). J. Mol. Spectroscopy, 8: 475-84(June 1961).

The proton magnetic resonance spectrum of $H_2C=C^{13}H_2$ in natural abundance (low-field half of $C^{13}H_2$ doublet only) and that of $H_2C=CHD$ was obtained and analyzed. The latter was treated as an ABCX system, complete matrix elements for which are given. These analyses permitted a determination of the magnitude of all the H–H coupling constants in ethylene as well as the C^{13}–H coupling. In addition the deuterium isotope effect on the shifts in ethylene-d_1 was studied and compared with that observed in other molecules. (auth)

20430 TIME-RESOLVED SPECTRA OF RARE-EARTH IONS. W. A. Hovis, Jr. (Johns Hopkins Univ., Baltimore). J. Opt. Soc. Am., 52: 649-55(June 1962).

An apparatus was developed for the study of the afterglow of a rare-earth spark with a time resolution of 0.1 μsec. A hydrogen thyratron controls a rapidly firing spark gap and the spectrum of the afterglow is recorded with pulsed photomultipliers and ratio techniques. Tests with praseodymium showed that it is possible to separate lines according to the ion of origin for the second, third, and fourth spectra, according to configuration of origin in the third spectrum of praseodymium, for example, the emission lines of the $4f^26p–4f^26s$ and $4f^25d–4f^3$ transitions. In the case of the $4f^25d–4f^3$ transition, some terms of the $4f^25d$ configuration are indicated from the more intense lines. The method developed with praseodymium were applied to neodymium, and some preliminary results are reported. (auth)

20431 INFRARED SPECTRUM OF DIDEUTEROACETYLENE (C_2D_2). Eugene D. Tidwell and Earle K. Plyler (National Bureau of Standards, Washington, D. C.). J. Opt. Soc. Am., 52: 656-64(June 1962).

Thirty bands of C_2D_2 were observed and measured between 1900 and 3300 cm^{-1}. Twenty of these were resolved well enough to permit extraction of rotational constants. The Δ_2F values up to J35 for three Σ_g ground state bands were averaged and correlated with other data for a more reliable $B_0 = 0.84794 \pm 0.00005$ and $D_0 = 7.85 \times 10^{-7} \pm 0.4 \times$

10^{-1}, where the indicated uncertainties are the probable errors of the coefficients. Better resolution and higher J values reduced the uncertainty derived from other sources. The l-type doubling constants for ν_4^1 and ν_5^1 were obtained from resolved Q branches and split P and R branches; they are $q_4 = 0.00316$ and $q_5 = 0.00314$ cm^{-1}. (auth)

20432 INVESTIGATIONS ON THE FLUORINATING BEHAVIOR OF UO_2 POWDERS OF VARIOUS ACTIVITIES. C. Fischer and H. Liebscher (Institut fllr Angewandte Physik der Reinststoffe, Dresden). Kernenergie, 5: 112-13(Feb. 1962). (In German)

The fluorinating behavior of UO_2 powders of various activities was investigated. The preparation of the UO_2 powder is described. The O/U ratio, which resulted by reoxidation after 14-day air exposure, was used as measurement for the activity of the sample. With increasing O/U ratio the fluorinating time and the UO_2 concentration in the UF_4 was decreased. (tr-auth)

20433 HYDROGEN-DEUTERIUM EXCHANGE ON ISOSTRUCTURAL SESQUIOXIDES OF THE FIRST LONG PERIOD. K. S. De and F. S. Stone (Univ. of Bristol, Eng.). Nature, 194: 570-1(May 12, 1962).

A study was made on the H_2-D_2 exchange on sintered specimens of the sesquioxides Ti_2O_3, V_2O_3, and Cr_2O_3. The results show that V_2O_3 is the most active oxide at high temperatures and the least active at low temperatures, and that Cr_2O_3 is the most active oxide at low temperatures. The results are discussed with respect to the crystal structure and the d orbitals of the metals, and it is concluded that the formation of a covalent d bond between the metal and adsorbed H_2 is the critical step in the catalytic exchange. (D.L.C.)

20434 USE OF AMINES IN INORGANIC HYDROLYSIS. I. L. Jenkins and J. Robson (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nature, 194: 864-5 (June 2, 1962).

The use of amines for the extraction of acids from aqueous solutions was applied to the hydrolysis of inorganic salts in aqueous solution without the introduction of any reagents into the aqueous phase. An amine that was immiscible with the aqueous phase was used to extract the acid formed on the hydrolysis of the salt and under suitable conditions insoluble complexes of UO_2^{2+}, Th^{4+}, Fe^{3+}, and $RuNO^{3+}$ were precipitated. Usually the anion was nitrate, but precipitations from sulfate media were also carried out. The precipitated complexes are probably of the type $UO_3 \cdot 2H_2O \cdot x$ amine and their stability varies with the type of amine. The method described can also be used for the examination of hydrolytic reactions taking place in aqueous solutions, again without introducing reagents into the aqueous phase. (P.C.H.)

20435 DENSITY MEASUREMENTS ON THE SULFURIC–URANYL SULFATE–WATER SYSTEM. L. Fischer (Hahn-Meitner-Institut für Kernforschung, Berlin). Nukleonik, 4: 77-9(Mar. 1962). (In German)

The density of aqueous sulfate solutions, as they are used in homogeneous reactors, was measured in the concentration range from 0.01 to 1.00 mol/l UO_2SO_4 at constant H_2SO_4 concentrations of 0.4 mol/l at temperatures between 20 and 50°C. Under these conditions the density of these solutions at constant temperature is almost linearly dependent on the UO_2SO_4 concentration, which is also valid for pure aqueous solutions for this salt. The effect of the sulfuric acid therefore appears to be additive. (tr-auth)

20436 MECHANISMS OF MICROCRACK GROWTH IN MAGNESIUM OXIDE CRYSTALS. F. J. P. Clarke, R. A. Sambell, and H. G. Tattersall (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Phil. Mag. (8), 7: 393-413(Mar. 1962).

The dislocation movements associated with microcrack growth in ascleaved single crystals of magnesium oxide were revealed by recording the associated birefringence changes in cine-film and by post-fracture examination. The observations suggest a mechanism by which cracks well below the critical Griffith size may grow; the mechanism is not exclusive however, and the conditions under which other mechanisms may operate are discussed. (auth)

20437 THE REBINDER EFFECT AND THE ADSORPTION-LOCKING OF DISLOCATIONS IN LITHIUM FLUORIDE. A. R. C. Westwood (Research Inst. for Advanced Studies, Baltimore). Phil. Mag. (8), 7: 633-49 (Apr. 1962).

Aqueous solutions of long-chain fatty acids can serve as etchants for lithium fluoride. Using such etchants it was possible to study the effects of various environments on the cross-gliding of screw dislocations at the surface of a crystal. The observations suggest that chemisorbed polar molecules restrict the motion of screw dislocations via adsorption-locking. An estimate of the possible strength of such locking is made and its existence confirmed by studies on the yielding behavior of lithium fluoride crystals. In contrast to Rebinder's observations with metal crystals, adsorbed polar molecules cause an increase in yield and critical resolved shear stresses before inducing the lower rate of work-hardening commonly known as the Rebinder effect. (auth)

20438 MAGNETIC AND CALORIC PROPERTIES OF NEODYMIUM MAGNESIUM NITRATE. G. J. C. Bots, B. S. Blaisse, and B. Goudswaard (Technische Hogeschoel, Delft, Netherlands). Physica, 28: 530-6(May 1962). (In English)

The anisotropic g-factor is measured by means of adiabatic demagnetization experiments in which the field strength and the direction of the field with respect to the crystal axis is varied. These experiments lead to $g_\perp = 2.66 \pm 0.05$ and $g_\parallel = 0.40 \pm 0.02$. In experiments on the specific heat, electrical heating is employed. The magnetic contribution to the specific heat is found to be $c_{magn}/R = 8.5 \times 10^{-4} \times T^{-2}$ per gram ion, and the specific heat of the lattice is found to be $c_{lat}/R = 0.52 \times 10^{-3} \times T^3$ per gram ion. (auth)

20439 THE ELECTRONIC STRUCTURE OF LIQUID METALS. S. F. Edwards (Univ. of Manchester, Eng.). Proc. Roy. Soc. (London), A267: 518-40(June 5, 1962).

An analysis is given of the electronic structure of liquids under conditions for which the almost free-electron approximation is applicable. An enumeration of the various conditions that can exist is given, based on the relative magnitudes of the mean free path and range of order in the liquid. The electronic properties are described in terms of the x-ray data, the curves of energy against momentum being given with calculations of the resistance and Knight shift. When considerable order is present the analysis is more complicated and the behavior of the energy momentum curves is given as the range of order varies from the extreme cases of no order to polycrystalline order. (auth)

20440 THE CRYSTAL STRUCTURE OF RUBIDIUM DI (META) FLUOROBERYLLATE ($RbBe_2F_5$) AND ITS RELATIONSHIP TO SILICATE SHEET STRUCTURES WITH $[Si_2O_5]$ UNITS. V. V. Plyukhin and N. V. Belov (Crystallography Inst., Academy of Sciences, USSR). Soviet Phys.-Cryst., 6: 685-93(May-June 1962).

The crystal structure of Rb difluoroberyllate was determined from xz and yz Patterson diagrams. The method of

integral characteristics played an important part in the determination. The structure suggests a relieved layer silicate. Brucite-type layers of Rb octahedra alternate with double flat $[Be_2F_5]_{\infty,\infty}$ networks made up from BeF_4 tetrahedra. The relationship was examined between this structure model and classical layer silicates, and also recently interpreted silicates containing no isolated packets, such as clay minerals, micas, and chlorites. (auth)

20441 THE SYMMETRY AND STRUCTURE OF STRONTIUM GERMANATE, $Sr(GeO_3)$, AS A STRUCTURE MODEL FOR α-WOLLASTONITE, $Ca(SiO_3)$. K. Dornberger-Schiff (Inst. of Crystal Structure, German Academy of Sciences, Berlin). Soviet Phys.-Cryst., 6: 694-700(May-June 1962).

The symmetry and structure of α wollastonite (pseudowollastonite), derived from the use of the synthetic compound $Sr_3(GeO_3)_3$ as a structure model were examined in detail. Compared to α wollastonite, $Sr_3(GeO_3)_3$ has the advantages that it crystallizes better and well-ordered crystals can be found as well as poorly ordered ones. In finding the positions of the atoms in space, however, difficulties were encountered which could not be overcome by traditional methods as a result of the OD-structure. Discussion is given on a proposed structure. (P.C.H.)

20442 THE CRYSTAL STRUCTURE OF BERYLLONITE ($NaBePO_4$). N. I. Golovastikov (Inst. of Crystallography, Academy of Sciences, USSR). Soviet Phys.-Cryst., 6: 733-9(May-June 1962).

The crystal structure of beryllonite ($NaBePO_4$) was determined. A model of the structure was found by analyzing the three-dimensional functions of interatomic vectors, as a result of which approximate coordinates were obtained for the P and Na atoms and also approximate positions of a large part of the O atoms in the xz projection. The model was refined by a series of successive approximations of the electron density projections ρ (xz) and ρ (yz). (auth)

20443 THE CRYSTAL STRUCTURE OF PRASEODYMIUM NITRATE HEXAHYDRATE $Pr(NO_3)_3 \cdot 6H_2O$. G. F. Volodina, I. M. Rumanova, and N. V. Belov (Inst. of Crystallography, Academy of Sciences, USSR). Soviet Phys.-Cryst., 6: 741-3(May-June 1962).

Parameters obtained for the unit cell of $Pr(NO_3)_3 \cdot 6H_2O$ are as follows: $a = 9.19 \pm 0.03$, $b = 11.70 \pm 0.04$, $c = 6.78 \pm 0.03$ Å, $\alpha = 89° \pm 30'$, $\beta = 110° 40' \pm 30'$, $\gamma = 110° 10' \pm 30'$. The lengths of the axes in certain directions are very close to one another and can easily be confused. With a density of specimens $\delta = 2.28$ g/cm^3 in a cell with such parameters there are two formula units of $Pr(NO_3)_3 \cdot 6H_2O$ (theoretical value of density $\delta = 2.27$ g/cm^3). A goniometric study of the existing material indicated the presence of a symmetry center in the structure. (P.C.H.)

20444 SYNTHETIC SCANDIUM SILICATES. N. A. Toropov and V. A. Vasil'eva (Inst. of Silicate Chemistry, USSR). Soviet Phys.-Cryst., 6: 779-83(May-June 1962).

The system scandium oxide–silica was studied and the diagram of state prepared. The following scandium silicates were detected in the system: scandium oxyorthosilicate, $Sc_2O(SiO_4)$, and scandium diorthosilicate, $Sc_2Si_2O_7$. There was a large region where two immiscible liquids existed. The compounds detected were synthesized and their melting points, densities, and optical properties were measured. There were shown to be important differences between the diagrams of state of the Sc_2O_3–SiO_2 and MgO–SiO_2 systems, in spite of the fact that the Mg^{2+} and Sc^{3+} ions are isomorphous in natural silicates. It was considered that the scandium silicates, in view of their stoichiometric compositions, high melting points, and ability to form immiscible liquids, are analogous to the silicates formed by the rare-earth elements. (auth)

20445 INFRARED AND RAMAN SPECTRA OF THE BORON TRIFLUORIDE-DIMETHYL ETHER COMPLEX. G. M. Begun, W. H. Fletcher, and A. A. Palko (Oak Ridge National Lab., Tenn.). Spectrochim. Acta, 18: 655-65 (May 1962).

The infrared spectra of liquid $B^{10}F_3 \cdot (CH_3)_2O$, $B^{11}F_3 \cdot (CH_3)_2O$, $B^{10}F_3 \cdot (CD_3)_2O$, and $B^{11}F_3 \cdot (CD_3)_2O$ were observed in the region 300 to 4000 cm^{-1}. The Raman spectra of these compounds were also examined. Assignment of the observed bands was made which is consistent with the structure of the molecule and the isotopic data. (auth)

20446 INTRAMOLECULAR HYDROGEN BONDS FORMED BY PRIMARY AROMATIC AMINES. THE N–H AND N–D STRETCHING FREQUENCIES OF MONO- AND DI-DEUTERATED AMINES. A. G. Moritz (Univ. of Adelaide). Spectrochim. Acta, 18: 671-9(June 1962).

The N–H and N–D stretching frequencies of a number of deuterated, intra-molecularly hydrogen-bonded amines were examined. For the mono-deuterated amines, these bands are interpreted on the basis of cis-trans isomerism of the NHD group. The relative shifts of the N–H and N–D stretching bands are discussed in terms of the strength of the intramolecular hydrogen and deuterium bonds. A method for the investigation of the tautomeric behavior of primary amino groups is presented. By this method it is shown that 4',5-dimethyl-2-aminoazobenzene exhibits rotational isomerism in solution. (auth)

20447 INFRA-RED AND RAMAN SPECTRA OF DIMETHOXY METHANE AND ITS DEUTERATED COMPOUNDS. Kenkichi Nukada (Government Chemical Industrial Research Inst. of Tokyo). Spectrochim. Acta, 18: 745-73(June 1962).

The infrared spectra in the region 3000 to 280 cm^{-1} and the Raman spectra in the region 3000 to 170 cm^{-1} of dimethoxy methane, dimethoxy methane-d_2, dimethoxy methane-d_6, and dimethoxy methane-d_8 are presented and the tentative assignment for most of the bands is suggested by comparison of these spectra with one another by analogy of them with those of other related compounds. (auth)

20448 SOME EXPERIMENTAL RESULTS ON AN EMISSION SOURCE FOR CONTINUOUS SPECTRA FOR THE VISIBLE TO X-RAY DOMAIN. Germaine Balloffet, Jacques Romand, and Jean Kieffer (Centre National de la Recherche Scientifique, Bellevue, France). Spectrochim. Acta, 18: 791-7(June 1962). (In French)

Results are given on the operation of a light source. It is a three-electrode vacuum spark of a special type, in which the electrical current reaches a high value by means of a coaxial circuit feeding the spark from the storage condenser. The observations show that the continuous spectrum, which extends from the visible to the extreme ultraviolet (80 Å), is emitted on the anode material or very close to it, and that its intensity depends on the anode material. The best results are obtained with uranium metal. Emission in the x-ray range was also observed. (auth)

20449 FINE STRUCTURE OF THE ELECTRONIC ABSORPTION SPECTRA OF URANYL COMPOUNDS. B. Jezowska-Trzebiatowska and A. Bartecki (Univ. of Wrocław, Poland and Inst. of Physical Chemistry, Polish Academy of Sciences, Wrocław). Spectrochim. Acta, 18: 799-807(June 1962).

The vibrational structure of electronic absorption spectra of uranyl compounds was studied and the results applied to the influence of solvents, and of the hydrogen ions in aqueous solutions of the uranyl ion. These investigations illustrate the influence of solvents upon the energy of vibrational transitions, changes of band intensity, and changes of general vibrational structure in the spectrum.

It is shown in the analysis that the vibronic spectra of the uranyl ion can be interpreted by superposition of vibrations on the electronic transitions. The magnitude of the totally symmetric vibration ν_1, the values of force constant, the distance U–O and the dissociation limit of a band progression 0″–n′ were determined. The potential curve of one of the electronic excited states of uranyl was calculated. The problem of the characteristic intensity distribution in the spectra of uranyl compounds is discussed. In this connection the influence of hydrolysis on the molecular structure of products of uranyl ion hydrolysis is explained. (auth)

20450 HEATS OF FORMATION OF METAL HALIDES: PENTABROMIDES OF NIOBIUM AND TANTALUM. P. Gross, C. Hayman, D. L. Levi, and G. L. Wilson (Fulmer Research Inst. Ltd., Stoke Poges, Bucks, Eng.). Trans. Faraday Soc., 58: 890-4(May 1962).

The heats of formation of the bromides of niobium and tantalum were determined by measuring, in closed vessels, the heat involved in the reactions of the metals with bromine vapor in contact with liquid bromine at 110°C. The experimental heats of reaction were 134.17 ± 0.06 kcal/mole for niobium bromide and 144.42 ± 0.10 kcal/mole for tantalum pentabromide, and the impurity corrections are −0.13 and +0.01 kcal/mole respectively; the derived values for the standard heats of formation are ΔH°_{298} ($NbBr_5$) = −132.85 kcal/mole and ΔH°_{298} ($TaBr_5$) = −142.96 kcal/mole. (auth)

20451 SOLVENT EXTRACTION FROM HALIDE SOLUTIONS. PART II. DILUTION STUDIES. A. T. Casey and A. G. Maddock (Univ. Chemical Lab., Cambridge, Eng.). Trans. Faraday Soc., 58: 918-22(May 1962).

Measurements of the extraction of protactinium from hydrochloric acid solution by different dilutions of mixtures of di-isopropyl carbinol and ketone, in the inert diluent benzene, failed to provide conclusive evidence of an extraction complex containing both carbinol and ketone. Benzene dilution of the carbinol showed that the complexes extracting from hydrochloric acid solutions containing trivalent gold and iron and pentavalent protactinium all contain the same number of molecules of carbinol. (auth)

20452 SOLVENT EXTRACTION STUDIES OF ION ASSOCIATION. SOME EUROPIUM COMPLEXES. P. G. Manning and C. B. Monk (University Coll. of Wales, Aberystwyth, Australia). Trans. Faraday Soc., 58: 938-41(May 1962).

Eu^{152} and Eu^{154} in tracer amounts and solutions of thenoyltrifluoroacetone (TTA) in toluene were used to investigate the first stage of association with acetate, glycollate, and sulfate at low ionic strengths and 25°C. An estimate of the first and second association constants of the tartrate has also been made. (auth)

20453 STUDIES OF ORGANO-ALKALI METAL COMPLEXES. PART V. THE REACTIVITIES AND VISIBLE SPECTRA OF COMPLEXES FORMED BY SOME ANILS, IMINES, HYDROCARBONS AND NITRO-COMPOUNDS. A. Mathias and E. Warhurst (Univ. of Manchester, Eng.). Trans. Faraday Soc., 58: 942-7(May 1962).

A number of complexes formed by alkali metals with some anils, imines, hydrocarbons, and aromatic nitrocompounds were prepared in dioxan solution. The relative reactivities towards organic halides of the sodium complexes were measured and the results compared with the values for other complexes. The linear relationship between the logarithm of the relative reactivity and orbital energy found previously is discussed further. The absorption spectra of the complexes in the visible region were determined. Further examples of a linear relationship between the frequencies of peak maxima and $1/(r_c + 2)$, where r_c is the radius of the alkali metal cation, were found. (auth)

20454 STUDIES OF ORGANO-ALKALI AND ALKALINE EARTH METAL COMPLEXES. PART VI. THE REACTIVITY AND SPECTRA OF SOME ORGANO-ALKALINE EARTH METAL COMPLEXES. A. Mathias and E. Warhurst (Univ. of Manchester, Eng.). Trans. Faraday Soc., 58: 948-52 (May 1962).

Methods for the preparation of alkaline earth metal complexes in dioxan are described. A preliminary attempt to define the extent of this field was made. The visible spectra and relative reactivities towards organic halides of the mono-benzophenone complexes were measured and the results compared with those for the corresponding alkali metal complexes. The linear relationship between the logarithm of the relative reactivity and $1/(r_c + 2)$, (where r_c is the radius of the cation) which was found previously for alkali metal benzophenones is shown to hold for the alkaline earth metal benzophenones. (auth)

20455 STUDIES OF ORGANO-ALKALI AND ALKALINE EARTH METAL COMPLEXES. PART VII. THE EFFECT OF ENVIRONMENT ON THE VISIBLE SPECTRUM OF THE BENZOPHENONE FREE RADICAL ANION. D. G. Powell and E. Warhurst (Univ. of Manchester, Eng.). Trans. Faraday Soc., 58: 953-6(May 1962).

The effect of added lithium bromide on the visible spectrum of the free radical anion of mono-lithium benzophenone in tetrahydrofuran was examined. The results indicated some form of clustering between the two species even at concentrations of less than 10^{-3} M. The positions of the peak maximum of mono-alkali metal benzophenones in toluene, dimethoxyethane, and dimethyl formamide were measured. The results are discussed in terms of the solvating powers of the media. (auth)

20456 NITRIDATION OF LITHIUM. E. F. McFarlane and F. C. Tompkins (Imperial Coll., London). Trans. Faraday Soc., 58: 997-1007(May 1962).

The kinetics of nitridation of lithium, both in the solid and in the molten state, were investigated in the temperature range 0 to 365°C and at pressures from 10 to 50 cm Hg. With the solid, the rate initially increased with extent of nitridation, an observation that is consistent with hemispherical growth of nitride into the metal; after a critical thickness was attained, however, the growth rate was constant. In this latter stage, the activation energy was negligibly small but the rate was dependent on pressure, suggesting that the rate-controlling process was the rate of passage of nitrogen through the porous nitride layer to the reactant Li/Li_3N interface by both streamline and Knudsen flow. There was considerable lack of reproducibility caused by physical changes in the porous layer, these thereby affecting the rate of inward diffusion of nitrogen. With molten lithium, the parabolic law was obeyed, the rate being independent of pressure and associated with an activation energy of 15.5 kcal/mole. The rate-determining process is probably the passage of lithium ions from the Li/Li_3N interface under a chemical potential gradient through a uniform lithium nitride layer. (auth)

20457 DIFFUSION KINETICS IN THE DISPLACEMENT CHROMATOGRAPHY OF UNIVALENT IONS. I. ION EXCHANGE EQUILIBRIUM OF UNI-UNIVALENT IONS ON THE CATION EXCHANGERS RF AND KU-2. S. Yu. Elovich and N. P. Sharapova (Inst. of Physical Chemistry, Academy of Sciences, USSR). Zhur. Fiz. Khim., 36: 789-95(Apr. 1962). (In Russian)

Ion exchange isotherms at constant ion strength were investigated for the ionic systems Cs^+-H^+ and Cs^+-Na^+ on the cation exchangers RF and KU-2. With the RF exchanger possessing a phosphoric acid functional group the isotherms were obtained both in the acid and alkaline regions. The concentration exchange constants (K_k) vary with coverage in all the isotherms investigated. The ion exchange isotherms obtained may be written as follows: $(q_1^{1/z_1})/(q_2^{1/z_2})^- = K_0 e^{\varepsilon q_0}(c_1^{1/z_1})/(c_2^{1/z_2})$ where z is the valency of the ion. It is suggested that Harned's rule may be applied to the ions adsorbed on the cation exchanger. (auth)

20458 DIFFUSION KINETICS IN THE DISPLACEMENT CHROMATOGRAPHY OF UNIVALENT IONS. II. DETERMINATION OF THE RATE OF MOVEMENT OF THE FRONT OF Cs IONS IN DISPLACEMENT CHROMATOGRAPHY. S. Yu. Elovich and N. P. Sharapova (Inst. of Physical Chemistry, Academy of Sciences, USSR). Zhur. Fiz. Khim., 36: 796-800(Apr. 1962). (In Russian)

Equations were derived for the movement of the equilibrium chromatographic front for varying concentration constants permitting calculations to be made without accounting for the activity coefficients in the solid phase. Treatment of data on the movement of the chromatographic zones shows that in the elution of cesium ions by hydrogen ions on the cation exchanger KU-2 and by sodium ions on RF (pH = 7.5) the process proceeds under equilibrium. Deviation from equilibrium takes place when cesium ions are eluted by hydrogen ions on the cation exchanger RF. The mean concentration differences are not large, not more than 2. The approach to equilibrium conditions for univalent ions in contrast to divalent ions is explained by the increase in diffusion coefficients of univalent as compared to multivalent ions. (auth)

20459 MOBILITY OF THE THORIUM ION. K. N. Kovalenko and Yu. V. Kushelev (Rostov Univ., USSR). Zhur. Fiz. Khim., 36: 814-15(Apr. 1962). (In Russian)

The electroconductivity of aqueous thorium nitrate solutions was investigated at concentrations between 0.0001 and 0.0050 g eq/l at 25°. The pH of the solutions was measured and the degree of their hydrolysis calculated. The limiting equivalent electroconductivity of thorium nitrate and the mobility of the thorium ion at infinite dilution were determined to be $\lambda_0^{25°} = 116.5$ ohm^{-1} cm^2 and $\lambda_{\frac{1}{4}Th^{4+}}^{25°} = 45.10$ hm^{-1} cm^2, respectively. (auth)

20460 INVESTIGATION OF THE ION EXCHANGE SORPTION OF RADIOELEMENTS BY SOILS. I. THE SORPTION OF RADIOCERIUM BY CHERNOZEM. E. A. Chuveleva, P. P. Nazarov, and K. V. Chmutov (Inst. of Physical Chemistry, Academy of Sciences, USSR). Zhur. Fiz. Khim., 36: 825-9(Apr. 1962). (In Russian)

Sorption of macro and micro amounts of cerium on chernozem takes place according to the ion exchange mechanism. The calcium by cerium exchange constant varies with cerium coverage of the chernozem. Sorption of micro amounts of cerium from solutions containing sodium, calcium, and cerium salts between 10^{-9} 10^{-4} N takes place predominately on the more active part of the soil, namely humic acid and analogous substances; montmorillonite is a weak sorbent. (auth)

20461 INVESTIGATION OF THE ION EXCHANGE SORPTION OF RADIOELEMENTS BY SOILS. II. INVESTIGATION OF THE Ce–Ca ION EXCHANGE EQUILIBRIUM ON HUMIC ACID. E. A. Chuveleva, K. V. Chmutov, and P. P. Nazarov (Inst. of Physical Chemistry, Academy of Sciences, USSR). Zhur. Fiz. Khim., 36: 830-2(Apr. 1962). (In Russian)

The concentration constant of exchange equilibrium between Ce and Ca on humic acid is 7.3. In respect to its adsorption capacity for rare earth elements, humic acid stands close to the cation exchanger KB-4. Sulfopolystyrene resin KU-2 is characterized by weak selectivity toward lanthanides. The hydrogen–cerium concentration exchange constant on humic acid sharply increases with increase in pH of the medium. (auth)

20462 INVESTIGATION OF THE ION EXCHANGE SORPTION OF RADIOELEMENTS BY SOILS. III. DETERMINATION OF THE DISSOCIATION CONSTANTS OF HUMIC ACID CARBOXYL GROUPS. E. A. Chuveleva, K. V. Chmutov, and P. P. Nazarov (Inst. of Physical Chemistry, Academy of Sciences, USSR). Zhur. Fiz. Khim., 36: 833-5(Apr. 1962). (In Russian)

The apparent dissociation constants of humic acid, KB-4 and SG-1, were determined by means of potentiometric titration and found to be 2.51×10^{-4}, 1.12×10^{-5}, and 2.0×10^{-5}, respectively. The acid may be used as sorbent to isolate ions from solution, the pH of which is 3 and higher. (auth)

20463 THE ISOTOPIC EFFECT IN THE ELECTROSYNTHESIS OF OZONE ACCORDING TO RAYLEIGH'S METHOD. I. A. Tikhomirov and V. N. Melenevskii ([Tomsk Polytechnic Inst., USSR]). Zhur. Fiz. Khim., 36: 895-6(Apr. 1962). (In Russian)

The experimental setup and data are described for the isotopic effect in the electrosynthesis of ozone by Rayleigh's method. The separation coefficient of 1.08 is in good agreement with previous findings. (auth)

20464 ON THE RELATION BETWEEN THE ACIDITY OF THE MEDIUM AND THE CHEMICAL SHIFT OF THE PROTON MAGNETIC RESONANCE IN AQUEOUS SOLUTIONS OF STRONG ACIDS. N. G. Zarakhani and M. I. Vinnik (Inst. of Chemical Physics, Academy of Sciences, USSR). Zhur. Fiz. Khim., 36: 916-17(Apr. 1962). (In Russian)

Published data show that proton magnetic resonance chemical shift in acids depends on concentration. The concentration shifts of proton magnetic resonance δ_n for HCl–H_2O, $HClO_4-H_2O$, HNO_3-H_2O, and $H_2SO_4-H_2O$ were measured with high accuracy. Correlations of the δ_n with H_0 acidity functions for these systems show that δ_n varies linearly with H_0. An analysis of the regularity indicates that the observed chemical shift determines the thermodynamic activity of solvated protons. (R.V.J.)

20465 PROCESS FOR THE CONCENTRATION OF ZIRCONIUM NITRATE SOLUTIONS. Irwin Samuel Zonis, James Malone Norwood, Jr., Edward Vincent Sherry, Jr., and Wayne Hicks Keller (to Columbia National Corp.). British Patent 897,748. May 30, 1962.

A process is given for concentrating an aqueous solution of zirconium nitrate without substantial precipitation of the zirconium, suitable for extraction with organic solvents. The process comprises heating the aqueous solution to between 175 and 220°F to vaporize water therefrom until the dissolved zirconium content is ≥0.5 lb/gal, and cooling the solution to below 175°F to minimize precipitation of solids, the total period of heating at >175°F being less than 60, preferably 30, min. An example of the process is given in which zircon sand was used to produce a zirconyl sulfate and finally a concentrated zirconium nitrate solution. (D.L.C.)

Radiation Chemistry and Radiochemistry

20466 (AERE-R-3409) THE DECOMPOSITION OF CERTAIN INORGANIC, ORGANIC AND AQUEOUS TARGET

ON PILE IRRADIATION. K. J. Taylor and G. T. Rogers (United Kingdom Atomic Energy Authority. Research Group, Wantage Research Lab., Wantage, Berks, England). Feb. 1962. 26p.

The effects of pile irradiation on a wide range of solid inorganic and organic compounds were studied to determine the safety of compounds frequently irradiated for radioisotope production. The amount and composition of gaseous radiation products were measured and other effects noted. The study of a series of hydrates showed that where the hydrate forms a liquid phase at pile operating temperature significant amounts of a stoichiometric mixture of hydrogen and oxygen are produced. These results provided information on safe techniques for the irradiation of the materials studied. (auth)

20467 (ASD-TDR-62-32(Pt.II)) TRIPLET EXCITATION INDUCED BY ELECTRON IRRADIATION. PART II. EXAMINATION OF AROMATIC SYSTEMS. John D. McCollum and W. A. Wilson (American Oil Co. Research and Development Dept., Whiting, Ind.). Jan. 1962. Contract AF33(616)-8247. 25p.

Flash spectroscopy was used to search for transient triplet absorption from eleven compounds irradiated by single electron pulses. Transients ascribed to triplets were found from 1,2-benzanthracene and p-terphenyl. Quenching of triplets in viscous paraffin oil appears sensitive to triplet structure; relative quenching rates of 8:3:1 were observed for p-terphenyl: 1,2-benzanthracene: anthracene triplets. Phenyl ether gives a transient probably assignable to phenyl radical. (auth)

20468 (BM-RI-5994) EFFECT OF IONIZING RADIATION ON THE CHLORINATION OF MIXTURES OF RUTILE, CARBON, AND VARIOUS CATALYSTS. A. A. Cochran and P. W. Martin (Bureau of Mines. Rolla Metallurgical Research Center, Mo.). Oct. 1961. 27p.

The effect of 44,000 r/hr of 120,000-volt x rays on the chlorination of pure mixtures of carbon, and various catalysts at temperatures up to 540°C is described. At these low temperatures, recoveries were very low; however, in the eight different systems studied, an increase in yield due to x rays was statistically significant in two instances and was of borderline significance in a third instance. In the other five systems, the differences in yield were not significant. Impurities and added catalysts caused relatively large variations in the yield of $TiCl_4$ from the reaction. Although the catalysts employed were reported in the literature as positive catalysts for the reaction, most of them were negative catalysts for the system studied. With only one exception, each increase in the purity of the charge resulted in a decreased yield of $TiCl_4$. The experimental results indicate that many substances catalyze the reaction studied and suggest that the differences in reactivity of the charge stocks may be due to their various contents of positive and negative catalysts. The theoretical and general considerations of radiation studies of metallurgical reactions were explored. As one result of these studies, a bibliography covering the main areas of interest to metallurgists was prepared. The scarcity of radiation studies of metallurgical reactions in the literature indicates the need for more research. (auth)

20469 (NAS-NS-3106) PAPER CHROMATOGRAPHIC AND ELECTROMIGRATION TECHNIQUES IN RADIOCHEMISTRY. R. A. Bailey (Rensselaer Polytechnic Inst.). [1962]. 55p.

"Nuclear Science Series" of the National Research Council. Committee on Nuclear Science.

A general review of techniques is presented along with discussions of principles involved, a survey of applications to various systems, and a collection of selected procedures as reported in the literature. (J.R.D.)

20470 (NP-11604) SOLID STATE RADIATION-INDUCED PHENOMENA. Quarterly Progress Report No. 8, November, December 1961 and January 1962. Hartmut Kallmann (New York Univ., New York). Feb. 1962. Contract DA 36-039SC-85126. 59p.

Quenching studies afford a convenient method for discriminating between the possible processes of non-radiative energy transfer. The similarities of the concentration dependence of energy transfer from solvent to solute to that of solvent quenching within the solvent system, and of the concentration dependence of energy transfer in liquids to that in rigid systems, show the importance of energy transport by migration in both liquid and rigid systems. Further support for migration was found in the reduction of quenching rate obtained upon dilution with a non-transferring liquid. The connection of energy transfer and quenching by the energy transport process was demonstrated by the use of o-terphenyl as a quencher in liquid systems. It was found that this compound acts both as a quencher and as an energy transferring agent. The question as to whether quasi particles, such as excitons, i.e., non-localized excited states of solids, can fulfill necessary conditions for a Bose-Einstein condensation, and whether such condensation can be observed is discussed. Although uncertainties of present data on excitons preclude precise numerical predictions, it was concluded that under certain experimentally attainable circumstances excitons fulfill the necessary conditions, i.e., condensation is possible. Ways of detecting the condensation are considered, and a specific experiment is proposed. The electroluminescent pulses obtained when applying various types of voltage waves to a ZnS phosphor in a castor wax matrix and in a tricresyl phosphate (T.C.P.) matrix are reported. With a voltage square wave and a biased voltage square wave the pulses are the same for the castor wax sample but the "off" peak is tremendously reduced for the T.C.P. sample. This is due to the polarization obtained in the latter, and is shown even more clearly with a delayed square wave. The importance of polarization in these samples is discussed. In addition, the results obtained when the polarization is released by light and infrared are given. The effects of x-ray or U.V. excitation on various ZnCdS phosphors is reported for both room and liquid nitrogen temperatures. Special emphasis was placed on the added effect of electrical fields and infrared irradiation, particularly on Mn activated phosphors. In general, luminescence quenching occurs at room temperature for the ZnCdS:Mn phosphors. This quenching can be reduced, in some cases only temporarily by infrared or electric fields; thus enhancement is observed. The luminescence is larger at liquid nitrogen temperature, and the above enhancement is decreased. (auth)

20471 (NYO-9485) FISSION PRODUCT APPLICATIONS USING GASEOUS BETA SOURCES. TASK II. Final Report. William W. Graessley and John H. Zufall (Air Reduction Co., Inc. Central Research Labs., Murray Hill, N. J.). Nov. 1961. Contract AT(30-1)-2343. 32p.

The influence of various types of electrical and magnetic fields on the rate of chemical reactions produced by ionizing radiation was studied. The types of fields chosen for investigation were electrostatic fields, megacycle-frequency electric fields, and rapidly fluctuating magnetic fields. The chemical system was the radiation-induced polymerization of acetylene. The radiation source was fission-product

krypton, which contains about 5% krypton-85, a beta emitter. For the study of electrostatic fields, a reactor system was developed in which strong fields could be produced with only limited and controllable electrical breakdown in the gas. It was found that an electrically-induced polymerization of acetylene occurred in addition to the radiation-induced reaction. However, no evidence was found for coupling between the radiation-induced reaction and the field, since at all times the rate with field and radiation acting together was the simple sum of the rate of reaction with these agencies acting separately. The solid product formed by the reaction had the property of retaining the krypton which was present during its formation with almost chemical compound-like tenacity. On the other hand, when exposed to air, the solid released some of the krypton rapidly. This suggests the possible utility of the solid polymer, impregnated with krypton 85, as an ultrasensitive oxygen detector. Studies carried on with high frequency electric fields (5 megacycle, 2 kilovolts) gave essentially the same results as the electrostatic field: no significant modification of the radiation-induced reaction by the field. A theoretical analysis of the magnetic fields indicated that the magnitudes necessary to produce appreciable effects in the reactant gases were well beyond the scope of commercial equipment, and this approach was abandoned. (auth)

20472 (BRL-79) QUARTERLY REPORT [ON] RADIATION RESEARCH, JANUARY 1, 1962–March 31, 1962. Fundamental Research No. 6041. (Mellon Inst. Radiation Research Labs., Pittsburgh). Apr. 12, 1962. Contract AT(30-1)-2310. 21p.

Equipment which provides a means of pulsing the Van de Graaff electron beam was installed. In other work, reports were issued during the period on ESR studies of transient organic radicals, mass spectrometric observations of electron and proton transfer reactions between positive ions and neutral molecules, second order splittings in the ESR spectra of organic radicals, method for measuring radio-induced radical yields, radiolysis of benzene, and photolysis and radiolysis of iodoethane. Other investigations in progress include measurement of radical lifetimes, radiolysis of ethylene, iodine reactions, radiolysis of alkyl halides, and radiolysis of isopropanol. (J.R.D.)

20473 (AEC-tr-5082) THE HOT SYNTHESIS OF COMPOUNDS LABELED WITH TRITIUM AND C^{14}. A. N. Nesmeyanov. Translated from p.269-90 of "Proceedings of the Symposium on Chemical Effects of Nuclear Transformations. Vol. II" (a publication of the International Atomic Energy Agency, Vienna, 1961). (STI/PUB/34(Vol.II)(p.269-90)). 21p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 16, abstract no. 11765.

20474 (CEA-tr-R-1476) OBTENTION DE ^{77}As SANS ENTRAINEUR A PARTIR DE GERMANIUM IRRADIE PAR DES NEUTRONS. (Obtaining Carrier-free As^{77} from Germanium Irradiated by Neutrons). V. I. Levin and M. M. Golutvina. Translated into French from Metody Polucheniya i Izmeren. Radioaktiv. Preparatov, Sbornik Statei, 64-76(1960). 23p.

A method for the preparation of carrier-free As-77 from irradiated Ge, based entirely on extraction by organic solvents, is given. In order to choose the optimum conditions for the recovery of As-77, the values of the distribution coefficients of Ge and As between hydrochloric acid solutions of different concentrations and organic solvents (carbon tetrachloride) were measured. The effect of the presence of iodine and of various reductants and oxidants on the distribution coefficients were studied. The preparation of samples for the activity measurements, which avoid the loses resulting from the volatilization of the compounds of As with Ge, was also investigated. Several variations of the separation methods were verified. (tr-auth)

20475 (CEA-tr-X-434) PREPARATION DES ENGRAIS MARQUES AUX ISOTOPES RADIOACTIFS. I. SUPERPHOSPHATES, SUPERPHOSPHATES DOUBLES. (Preparation of Fertilizers Tagged with Radioactive Isotopes. I. Superphosphates, Double Phosphates). G. Varga, F. Máté, and L. Gruber. Translated into French from Agrokémia és Talajtan, 9: 527-32(1960). 11p.

Three labeling techniques were used to prepare radioactive superphosphates and double phosphates. Distributions of radioactivity in these two fertilizers were studied. It was found that only the hydrosoluble fraction of P_2O_5 was labeled independently of the labeling method in both series. The fractions soluble in citric acid are formed because of modifications of the apatite crystalline lattice. Superphosphates labeled by the techniques described can be used for investigations, but their specific radioactivity should be related to the hydrosoluble fraction of P_2O_5 or erroneous results will be obtained. The labeled doubled superphosphates can be used without regard to the type of study with no danger of error. (tr-auth)

20476 ELECTRON SPIN RESONANCE OF GAMMA-IRRADIATED GLASSES. Yoshihiko Shono, Shigeharu Koshino, Toshio Yoshida, and Takeyoshi Seiyama. Ann. Rept. Radiation Center Osaka Prefect., 2: 85-6(1961). (In English)

Electron spin resonance measurements are reported for gamma-irradiated borosilicate and soda-lime glasses. The spectrum of irradiated borosilicate glass is rather complex. Annealing reduces the spectrum of soda-lime glass but does not change its shape. However, for borosilicate glass, the effects of annealing depend on the dose; for example, one line which annealed out at 170°C for 10^8 r required higher annealing temperatures for 10^5 and 6×10^5 r. (D.L.C.)

20477 ELECTRON MICROGRAPHS OF DARKENED ZnS PHOSPHORS. Takeyoshi Seiyama and Toshio Yoshida. Ann. Rept. Radiation Center Osaka Prefect., 2: 87-90 (1961). (In English)

Electron micrographs were made of ZnS phosphor surfaces exposed to light from a Xe lamp in moist air and compared with those of non-darkened phosphors. The ZnS samples investigated included unactivated ZnS and Cu-activated ZnS containing 0.01 and 0.5 wt % Cu. Precipitates were found on surfaces of unactivated ZnS and ZnS containing 0.01 wt % Cu upon darkening; some of the precipitates run parallel to the growth steps. For ZnS containing 0.5 wt % Cu, no remarkable change was found after darkening. The precipitates are probably colloidal Zn. (D.L.C.)

20478 RADIATION INDUCED REACTION OF SILICON HYDRIDE. Wataru Ando and Shigeru Oae. Ann. Rept. Radiation Center Osaka Prefect., 2: 95-9(1961). (In English)

Gamma irradiations were carried out on SiH_4 alone and in mixture with CO_2, H_2O, and C_2H_2. The G value for H_2 formed from irradiated SiH_4 alone was found to decrease with SiH_4 pressure and dose but increased in the presence of CO_2, H_2O, and C_2H_2. Possible mechanisms for this increase in $G(H_2)$ are given. (D.L.C.)

20479 THE RADIATION-INDUCED OXIDATION OF STANNOUS CHLORIDE IN AQUEOUS HYDROCHLORIC ACID. Ken'ichi Sugimoto and Shigeru Oae. Ann. Rept.

Radiation Center Osaka Prefect., 2: 100-5(1961). (In English)

The radioinduced oxidation of stannous to stannic ions in 6 N HCl oxygen-free solutions was studied with Co^{60} gamma radiation. The stannic ion yield was found to be proportional to dose and to be independent of dose rate and initial stannous chloride concentration over a wide range, but it increases when the stannic ion concentration is high or oxygen is present. The oxidation mechanism is discussed. The results can be interpreted to mean that the stannous ions are oxidized by OH radicals. The use of stannous ions for dosimetry is suggested. (D,L,C.)

20480 HOT-ATOM CHEMISTRY OF HALOGENS IN COBALTAMMINE COMPLEX SALTS. II. HOT-ATOM CHEMISTRY OF RADIOBROMINE IN PENTAMMINE COBALT(III) BROMIDES AND BISETHYLENEDIAMINE COBALT(III) BROMIDES. Nobufusa Saito, Takeshi Tominaga, and Hirotoshi Sano (Tokyo Univ.). Bull. Chem. Soc. Japan, 35: 63-7(Jan. 1962). (In English)

The fate of energetic radiobromine atoms arising from the (n,γ) reaction on bromine in solid complex salts of the formulas $[Co(NH_3)_5X]\ Br_{2,3}$ and $[Co(en)_2X_2]\ Br_{1,3}$ was investigated. The fraction of the total radiobromine produced finally retained in ligands (ligand yield) was found to increase as a function of the mass of the donor in ligand X. Therefore, it was suggested that the kinetic processes might play an important role in recoil reaction in the solid complex salts. (P.C.H.)

20481 A METHOD OF RADIATION VULCANIZATION. M. Ya. Kaplunov, Z. N. Tarasova, V. T. Kozlov, and B. A. Dogadkin. Byull. Izobret., No. 13, 43(1961).

A method of radiation vulcanization of rubber mixtures on a base of synthetic rubber with organic additives is described. It is distinguished by the fact that, in order to increase the static strength of the radiation vulcanizers at 100°C up to 210 kg/cm², coumarone-indene resin is used as an organic additive. (OTS)

20482 THE EFFECT OF IONIZING RADIATION ON THE CATALYTIC ACTIVITY OF ALUMINUM OXIDE IN THE DEHYDRATION OF N-DODECYL ALCOHOL. Vikt. I. Spitsyn, I. E. Mikhailenko, and G. N. Pirogova (Inst. of Physical Chemistry, Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R., 143: 1152-5(Apr. 11, 1962). (In Russian)

Three series of experiments were carried out. The aluminum oxide catalyst having a grain size of 1 to 2 mm was irradiated at a flux of $\sim 0.8 \times 10^{13}$ neutrons/cm²-sec in a reactor. The dehydration of the alcohol was carried out with an aluminum oxide catalyst containing 19.4% $CaCl_2$. A number of experiments were run with the incorporation of Ca^{45} in the catalyst (39.1 mc Ca^{45} per gram of catalyst). Finally, the catalyst and the alcohol vapors were irradiated with 800 kev electrons from an accelerator with a dose of 10^{20} ev per gram of catalyst. Neutron irradiation shows a loss in catalytic activity which increases with increasing time of irradiation of the catalyst in the reactor. The incorporation of radioactivity in the catalyst and external irradiation with fast electrons show an increase in catalytic activity. The yield of α-dodecene is a maximum with the use of a catalyst containing radioactive Ca^{45}. (TTT)

20483 GRAFTING AND POLYMERIZATION UNDER RADIATIONS. M. Magat. Énergie nucléaire, 4: 124-8 (Mar.-Apr. 1962). (In French)

Radiation chemistry has applications in the polymerization and modification of polymers. Three stages characterize the application of radiation to polymerization: polymerization of liquid monomers, pure or in solution (vinyl monomers); initiation of polymerizations at low temperature; and polymerization in the solid state (at room temperature or at low temperature). Chemistry under radiations is discussed as concerns the modification of polymers by grafting and cross-linking. (auth)

20484 SOME RECENT TRENDS IN NUCLEAR CHEMISTRY. M. A. Rollier (Università, Pavia, Italy). Energia nucleare (Milan), 9: 226-30(Apr. 1962). (In Italian)

Some recent trends in nuclear chemistry are surveyed, as they appear from papers presented at the Gordon Conference on Nuclear Chemistry (1960), at the International Conference on the Use of Radioisotopes in the Physical Sciences and Industry held in Copenhagen under the joint auspices of IAEA and UNESCO (1960), at the 18th International Congress of Pure and Applied Chemistry of Montreal (1961), and at the Conference on Fission and Spallation Phenomena and Their Applications to Cosmic Rays organized by CERN in Geneva (1961). The development of basic research in the field of nuclear chemistry makes it more and more difficult to make a distinction between the fields of nuclear physics and nuclear chemistry. An interesting feature of the trends of basic research in this field is the study of nuclear reactions produced by very high energy particles. (auth)

20485 THE DEPENDENCE OF THE RADIOINDUCED FORMATE OXIDATION IN THE CATALASE–C^{14}-FORMATE SYSTEM ON VARIOUS MILIEU FACTORS. H. Aebi and J. P. Heiniger (Universität, Bern). Helv. Chim. Acta, 45: 580-90(1962). (In German)

Radiation-induced C^{14}-formate oxidation was studied under a variety of experimental conditions. Since the $C^{14}O_2$ yield can be increased by traces of catalase, an enzymatic and a nonenzymatic component may be distinguished. Either component of $C^{14}O_2$ formation is influenced by temperature, pH, gas phase, and irradiation techniques in a different manner. Highest yields are observed in N_2O phase (G_{+CO_2} = 7 to 8). Whereas an increasing effect of catalase is observed in O_2 and N_2O, there is none in N_2. A small but distinct dose-rate dependency exists between 35 and 400 r/min (250 kv x rays). (auth)

20486 INVESTIGATION OF γ-IRRADIATED VINYL POLYMERS BY MEANS OF ELECTRON PARAMAGNETIC RESONANCE. Sheng-k'ang Ying, A. N. Pravednikov, and A. E. Kolmanson. Hua Hsüeh Hsüeh Pao, 26: 164-8(1960).

In radiolysis of polyvinyl chloride and polynitrile acrylic acid, the concentration of free radicals was determined by means of electron paramagnetic resonance decreases with rising temperature. (Irradiation was performed below vitrification temperature.) The yield of free radicals obtained by radiolysis of polyvinyl chloride was higher than that obtained by radiolysis of polyethylene, whereas the yield of cross links is lower. It is believed that electrons produced by radiolysis of polyvinyl chloride can be captured by polymer molecules. (OTS)

20487 A SMALL CIRCULATING LOOP FOR ELECTRON IRRADIATION OF LIQUIDS. W. S. Guentner and T. J. Hardwick (Gulf Research and Development Co., Pittsburgh). Intern. J. Appl. Radiation and Isotopes, 13: 98-9 (Feb. 1962). (In English)

A circulating system which permitted electron irradiation of liquids at constant temperature between 0 and 95°C and at pressures up to 200 psi was remodeled. New features include: a smaller charge volume (350 to 400 ml), a wider temperature range, greater ease and rapidity of cleaning between samples, and readily interchangeable parts. A description is presented of the degassifier, irra-

diation cell, heat exchanger, and pump. All materials are stainless steel. (M.C.G.)

20488 AN EXPRESSION FOR SOURCE COUNTING RATE REQUIRED IN TRACER EXPERIMENTS. J. L. Putman (Wantage Research Lab., Berks, Eng.). Intern. J. Appl. Radiation and Isotopes, 13: 99-100(Feb. 1962). (In English)

The expression $S = S_0 (1 + 2\sqrt{b/s_0})$, where S is source contribution, S_0 is source contribution when background rate is 0, and b is background rate, was found to be useful for rapid calculation of source activities required in practical experiments. (M.C.G.)

20489 A RAPID MEASUREMENT OF I^{131} IN TELLURIUM IRRADIATED BY NEUTRON. E. Hatzopoulos and S. Tsiklis (Centre d'Études Nucléaires, Saclay, France). Intern. J. Appl. Radiation and Isotopes, 13: 101-3(Feb. 1962). (In French)

The neutron-irradiated sample is stored up to 21 days in order to allow the short-lived component of Te to die out. The sample's activity is then counted using an ionization chamber, both with and without a 148-mg/cm^2 Al foil interposed between source and detector. From a knowledge of the relative absorption coefficients of the radiations from I^{121} and Te, the activity of the I^{131} can be determined. The method has an accuracy between 5 and 10% for millicurie activities of I^{131}. (T.F.H.)

20490 LABELLING HYDROCARBONS BY EXCHANGE WITH WATER. B. E. Gordon and J. A. Van Klaveren (Koninklijke/Shell Laboratorium, Amsterdam). Intern. J. Appl. Radiation and Isotopes, 13: 103-5(Feb. 1962). (In English)

A study was made to see if other, widely available catalysts (other than Pt) could be found to accomplish the exchange between T_2O and hydrocarbons of the various types. The catalysts tried were high-surface-area alumina, Co/Mo/O on Al_2O_3, and Co/Mo/S on Al_2O_3. Several representative hydrocarbons were used. The Co/Mo/S on Al_2O_3 was the best of the three catalysts tested. (M.C.G.)

20491 ON THE TRANSFER OF ENERGY IN RADIOLYSIS. A. M. Brodskii, Yu. A. Kolbanovskii, and L. S. Polak (Moscow State Univ.). Intern. J. Appl. Radiation and Isotopes, 13: 143-54(Mar. 1962). (In English)

The transfer of energy in radiolysis in the presence of minor amounts of excitation acceptors is considered. A theory for direct electromagnetic energy transfer from an excited molecule to a molecule of the acceptor is derived from experimental data on the decrease in the radiation-induced yield as a function of concentration. A corresponding law is deduced and certain relations predicted. The latter are confirmed by experimental data. (auth)

20492 THE SYNTHESIS OF ORGANIC PRODUCTS FROM AN AQUEOUS SOLUTION OF CO_2 UNDER THE INFLUENCE OF Co^{60} GAMMA RADIATION. N. Getoff (Institut für Radiumforschung und Kernphysid der Österreichische Akademie der Wissenschaften, Vienna). Intern. J. Appl. Radiation and Isotopes, 13: 205-13(Apr. 1962). (In German)

Under the influence of Co^{60} gamma rays, an aqueous solution of CO_2 was reduced to form organic products such as aldehyde, formic acid, oxalic acid, and glycol. The aldehyde and formic acid are considered the primary products of the reduction and their yield was consequently studied in detail in the pH region from 2 to 10.9 as a function of the radiation dose. The formation of both products shows a strong dependence on the pH value of the irradiated solution. The curve of the hydrogen peroxide formed at the same time has a similar shape in the acid range to that of the aldehyde. It appears that the ferric ions provide a certain amount of protection for the organic substances in process of formation against the radicals present. In order to explain the reduction process of the CO_2 in aqueous solution, a number of reaction mechanisms are assumed. (auth)

20493 URANYL OXALATE ACTINOMETER FOR MICROPHOTOCHEMISTRY. K. Porter and D. H. Volman (Univ. of California, Davis). J. Am. Chem. Soc., 84: 2011-12(May 20, 1962).

A simplified method of uranyl oxalate actinometry based on the carbon monoxide formed rather than on the oxalate destroyed was developed. The CO was determined by a flame ionization detector after catalytic hydrogenation to methane. (M.C.G.)

20494 NEUTRON ACTIVATION AS A METHOD FOR LABELLING THE PHOSPHORUS OF NUCLEOTIDES. Henry G. Mautner (Yale Univ., New Haven), Barbara Donnelly, Calvin M. Lee, and G. W. Leddicotte. J. Am. Chem. Soc., 84: 2021(May 20, 1962).

The use of neutron activation in labeling the phosphorus of nucleotides was investigated. Samples of organic phosphates were irradiated and their radioactivity determined. P^{32} was found to be present indicating that neutron activation is a useful tool for labeling phosphorus-containing compounds. (M.C.G.)

20495 PRIMORDIAL ORGANIC CHEMISTRY. I. COMPOUNDS RESULTING FROM ELECTRON IRRADIATION OF $C^{14}H_4$. Christof Palm and Melvin Calvin (Univ. of California, Berkeley). J. Am. Chem. Soc., 84: 2115-21 (June 5, 1962). (UCRL-9934)

C^{14}-labeled methane, together with a number of other presumed primordial gases of the earth's atmosphere, was subjected to electron bombardments. The products formed were examined by paper chromatography, ion exchange chromatography, mass spectrometry, and ultraviolet light spectrophotometry. A number of minor molecules were specifically identified, and urea was found as a major component in the absence of added phosphine; the formation of urea is inhibited by added phosphine. Most of the products can be accounted for as discrete molecules, even though they are as yet unidentified. (auth)

20496 ELECTRON SPIN RESONANCE STUDY OF RADIATION DAMAGE IN SINGLE CRYSTALS OF dl-ASPARTIC ACID. Thadho S. Jaseja (Univ. of Maryland, College Park) and Roy S. Anderson. J. Chem. Phys., 36: 2727-30(May 15, 1962).

Single crystals of dl-aspartic acid were examined by the electron spin resonance method after being damaged at room temperature by x irradiation. Analyses of the resulting spectra suggest that the mechanism of the damage is the removal of the amino group, resulting in a stably trapped radical. The three protons nearest to the unpaired electron were nonequivalent. The observed values of the isotropic π-electron–π-proton hyperfine couplings were 115 ± 2 and 18 ± 2 Mc. Two nonequivalent radical sites were detected. The values of the two nonequivalent anisotropic π-electron–σ-proton hyperfine interactions were observed to be 90 ± 3 and 50 ± 3 Mc along one axis. Interpretation of the π-proton couplings indicates that one of the methylene C–H bonds lies parallel to the π orbital of the unpaired electron, whereas the other C–H bond in the methylene group makes an angle of 113° with this direction. Comparison of the spectra from the two nonequivalent radical sites suggests that the angle between these is 60 ± 10°. These conclusions were confirmed by similar studies of single crystals of deuterated dl-aspartic acid. (auth)

20497 THE RADIATION CHEMISTRY OF α-PINENE. T. H. Bates, J. V. F. Best, and T. Ffrancon Williams (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Chem. Soc., 1521-30(May 1962).

Gamma irradiation of α-pinene at 30° results in formation of hydrogen, isomers of α-pinene, and polymeric material corresponding to a number-average molecular weight given by $(C_{10}H_{16})_{2.1\pm0.1}$. Initial G yields of hydrogen and monomer conversion into polymer are 0.5 and 5.2 molecules per 100 ev, respectively. Isolation of the individual isomeric products by gas-liquid chromatography and their identification by infrared and ultraviolet spectroscopy reveal allo- and ocimene as the major constituents with initial G values of 0.9 and 2.6, respectively. Spectrophotometric determination of ocimene by the absorption peak at 237 mμ gives a G value of 2.8. (+)-α-Pinene is partly racemized on irradiation, with a G yield of 1.6. Formation of ocimene is attributed to release of excess vibrational energy in an α-pinene molecule subjected to excitation. The racemization implies formation of an intermediate which can revert to either the (+)- or the (−)-form. It is suggested that an internal ion pair intermediate could result from the primary processes of ionization and electron capture within a rearranged α-pinene molecule; the subsequent diverse reactions of the proposed internal ion pair are depicted as leading to dipentene, polymer, or optically inactive α-pinene. (auth)

20498 THE RADIATION CHEMISTRY OF β-PINENE. T. H. Bates, J. V. F. Best, and T. Ffrancon Williams (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Chem. Soc., 1531-40(May 1962).

On irradiation with Co^{60} γ rays, dry β-pinene polymerizes in vacuo, to give a product which is partially precipitated from the liquid monomer. The kinetics of the reaction were followed by using dilatometers. At 25–30° with a constant dose rate (2.55×10^{17} ev g^{-1} min^{-1}), polymer formation is linear with time of irradiation up to 60% conversion and the mean yield corresponds to the polymerization of 850 monomer molecules per 100 ev. A decrease in dose rate results in a higher yield per unit dose. The rate shows a positive temperature coefficient in the range −35 to +55°. The polymers are formed with a range of molecular weights and a number-average value of 1360 is obtained for the chloroform-soluble fraction; the insoluble polymer is of higher molecular weight and melts at 220°. Infrared and nuclear magnetic resonance spectra together with the determination of iodine values indicate the presence of unsaturated groups in the polymer structure. The polymerization yield is sensitive to the drying technique employed for the monomer and the rate of a dry reaction is strongly retarded by added water although the molecular weight of the resultant polymer is unaffected. Evidence of initiator transfer to monomer during the dry polymerization, as well as the marked effect of water, strongly support the participation of ions in the mechanism. A concurrent isomerization of β-pinene to dipentene ensues during the polymerization with a yield of 12 molecules per 100 ev; other isomers are also formed in comparable yields. (auth)

20499 OXIDATION OF ORGANIC SULPHIDES. PART XI. THE SYNTHESIS OF SPECIFICALLY LABELLED PHENYL [^{35}S] BENZENETHIOLSULPHINATE AND PHENYL BENZENETHIOL [^{35}S] SULPHONATE. D. Barnard and E. J. Percy (National Rubber Producers' Research Assn., Welyn Garden City, Herts, Eng.). J. Chem. Soc., 1667-71 (May 1962).

A simple method is described which gives high yields of phenyl [S^{35}] benzenethiolsulfinate, labeled at either of the two possible positions, from [S^{35}]thiophenol. Reaction of these products with 1-chloro-2,4-dinitrobenzene is shown to give 2,4-dinitrophenyl phenyl sulfoxide, which can be used to assess the specificity of the radio-labeling. The synthesis of phenyl benzenethiol[S^{35}]sulfonate from [S^{35}]thiophenol is also described. (auth)

20500 THE DEVELOPMENT OF SEPARATION METHODS FOR THE RECOVERY OF THE RADIOISOTOPES P^{32} AND I^{131} FROM IRRADIATED MATERIAL. D. Geithoff (Kernforschungszentrum, Karlsruhe, Ger.). Kerntechnik, 4: 45-50(Feb. 1962). (In German)

The rapid increase in the production of radioisotopes in the last 15 years has accelerated the development of separation methods. This is especially true for important radioisotopes such as P^{32} and I^{131}. During the evolution of various methods, increased experience in processing radioactive material has led to simplified separation procedures and the recovery of products of higher radiochemical purity. The evolution of these methods is briefly sketched. (tr-auth)

20501 THE LET- DEPENDENCE OF THE RADIATION REACTIONS OF POLYVINYL ACETATES IN SOLUTION. Arnim Henglein, Wolfram Schnabel, and Edgar Heckel (Hahn-Meitner-Institut für Kernforschung, Berlin). Makromol. Chem., 49: 41-51(1962). (In German)

Solutions of polyvinyl acetate in trimethylborate were exposed to Co^{60}-γ radiation, to 120 kev-bremsstrahlung, and to thermal neutrons at various dose rates. The observed effects were independent of dose rate. However, they strongly depended on the LET (linear energy transfer) of the radiations. Gamma and x rays rapidly crosslinked the polymer. The densely ionizing He^4/Li^7-particles from the exothermic nuclear reaction $B^{10} + n \rightarrow He^4 + Li^7$ caused degradation of the polymer. Solutions that were solidified beyond the gel point under γ-irradiation became liquid again when subsequently exposed to He^4/Li^7-radiation. These experiments showed that the ratio p_0/q_0 (p_0, q_0: specific degradation and crosslinking densities) increases with increasing LET. Several mechanisms are discussed which may basically explain LET effects in polymers. Two "classical" explanations in terms of different initial concentrations of intermediate radiolysis products in the tracks of ionizing particles are given: q_0 may be decreased by the depression of transfer reactions between solvent radicals and intact macromolecules in favor of radical-radical reactions at high LET; p_0 may be increased at high LET since primary recombinations of end-group-macroradicals will be prevented by solvent radicals in the same cage. Another explanation considers multiple ionization and excitation of molecules by particles of high LET. Dissociation of multiply ionized macromolecules may result in a complete change of the ratio p_0/q_0. Furthermore, the introduction of several radical spots into one macromolecule may lead to intramolecular instead of intermolecular crosslinking. (auth)

20502 RADIOCHEMICAL BLOCK AND GRAFT COPOLYMERIZATION OF POLYMETHYLMETHACRYLATE WITH ACRYLONITRILE. Christel Schneider, Jakob Herz, and Dieter Hummel (Universität, Cologne). Makromol. Chem., 51: 182-98(1962). (In German)

Graft and block copolymers were prepared by grafting acrylonitrile onto pre-irradiated aqueous dispersions of polymethylmethacrylate. The influence of different experimental conditions as irradiation time, dose rate, and the time between irradiation and addition of the monomer on the course of the reaction was studied. Fractional precipi-

tation of the copolymer showed no homopolymer acrylonitrile, but only a fractionation according to a decreasing content of polyacrylonitrile. Determination of the molecular weight by measuring the intrinsic viscosity in dimethylformamide led to an average molecular weight of 300,000 to 325,000. Analogous grafting on other polymethacrylates was only successfull in the case of polyethylmethacrylate. This fact allows a conclusion to the structure of the initiating radicals in the pre-irradiated dispersions. The kinetics of the radical formation are given by $dR/dt = k \cdot I - k'(R)^2$ corresponding to those of the radical formation in solid polymethylmethacrylate. (auth)

20503 SOLID STATE POLYMERIZATION OF OXETANES BY IONIZING IRRADIATION. Seizo Nakashio, Masatsune Kondo, Hiro Tsuchita, and Masasuke Yamada (Takarazuka Radiation Lab., Japan). Makromol. Chem., 52: 79-97(1962). (In English)

In the radioinduced polymerization of 3,3-bis(halogenomethyl) oxacyclobutanes, the rate in solid state is much more rapid than in the liquid state including solution system. This rate depends on the crystal state and is more rapid in proportion as the orientation of crystals being preferable. It was observed that the reaction rate also depended on the crystal size and was more rapid with larger crystals. Saturation points of polymerization yield were observed, and these points also depended on the crystal state. X-ray diffraction analysis was used to explore the solid state polymerization of a single crystal of 3,3-bis (chloromethyl) oxacyclobutane; it was observed that the degree of orientation of the crystal is an important factor in the solid state polymerization. The preferred orientation of the crystal affected that of its polymer. The rate of polymerization was proportional with the dose rate whereas the degree of polymerization was less dependent. The activation energy of the polymerization of 3,3-bis(chloromethyl) oxacyclobutane is equal to 4.1 kcal/mole in the range of −30 to 19°C (m.p. of the monomer), 0.3 kcal/mole below −100°C. These solid state polymerizations may be assumed to proceed by an ionic mechanism. In the polymerization of derivatives of 3,3-bis(halogenomethyl) oxacyclobutanes the reaction proceeds with rates in the following order; $Cl^- > Br^- \gg I^-$. (auth)

20504 GEL FORMATION IN POLYVINYL CHLORIDE ON IRRADIATION. M. A. Crook and B. J. Lyons (British Insulated Callender's Cables, Ltd., London). Nature, 194: 734-5(May 26, 1962).

The probable mechanism of crosslinking of polyvinyl chloride is discussed. A plot of log sol fraction vs dose for radioinduced gelation of polyvinyl chloride shows that the powdered samples gel at lower doses than film samples. A comparison of gelling doses with and without unsaturated additives suggests that the chain mechanism requires radiolytic formation of unsaturation. Heating of polyvinyl chloride to 50°C in vacuum after irradiation results in increased gelation and evolution of hydrochloric acid; this increase is probably due to an increase in unsaturation from the thermal treatment. (D.L.C.)

20505 NATURE OF THE PRECURSORS OF MOLECULAR PRODUCTS IN THE RADIATION CHEMISTRY OF WATER. E. Hayon (Cambridge Univ., Eng.). Nature, 194: 737-40(May 26, 1962).

Research on radiation chemistry of water is reviewed with respect to the precursors of molecular hydrogen. Evidence is presented that the primary reducing species is the hydrated electron, H_2O^-, and that molecular hydrogen is formed by two mechanisms, the major one being recombination of H_2O^- and the minor one being recombination of H atoms formed by H^+ reacting with H_2O^-. (D.L.C.)

20506 RADIATION DECOMPOSITION OF SODIUM CHLORATE. P. F. Patrick and K. J. McCallum (Univ. of Saskatchewan, Saskatoon, Can.). Nature, 194: 766-7 (May 26, 1962).

The effects of annealing on the radiolysis of sodium chlorate were studied. Crystals were irradiated at room temperature and then heated for varying times up to 25 hr at 50 to 210°C. The most striking change was in the chloride yield, G_{Cl^-}. On annealing at 50°C, G_{Cl^-} reaches a maximum of 1.38 (unannealed $G_{Cl^-} = 0.95$) and then falls, leveling off at 0.55. At the higher temperatures, G_{Cl^-} increases, but the later decrease does not occur. (D.L.C.)

20507 RADIATION PROTECTION WITH SULPHUR AND SOME SULPHUR-CONTAINING COMPOUNDS. A. Charlesby, P. G. Garratt, and P. M. Kopp (Royal Military Coll. of Science, Shrivenham, Swindon, Eng.). Nature, 194: 782(May 26, 1962).

Colloidal sulfur suspensions of very low concentrations (5 to 50 μg/cc) are reported to have an efficient protective effect against radioinduced crosslinking in polydimethyl siloxane fluids and dilute aqueous solutions of polyvinylpyrrolidone. A similar protective effect was shown by many sulfur compounds in the polyvinylpyrrolidone solutions. (D.L.C.)

20508 RESOLVING POWER WITH TRITIUM AUTORADIOGRAPHS. D. K. Hill (Postgraduate Medical School, London). Nature, 194: 831-2(June 2, 1962).

A practical direct test was made of the autoradiographic image of a tritium labeled structure of known configuration. Two methods were used. In the first, a straight edge of Araldite epoxy resin, made radioactive by combination with tritiated succinic acid, presented itself to the emulsion. The second method was less direct in its approach. A face was cut on a block of the radioactive Araldite and the angle of cutting was then altered by 0.5 μ so that subsequent sections were in the form of wedges, tapering in thickness. Discrepancy between the results by the two methods is possibly accounted for by inadequate allowance for grain size. This would mean an overestimate of the band-width by the first method and an underestimate in the second. If this is so, it may be concluded that a disk source will produce an image in which 50% of the grains, when pin-pointed, lie in a band of width somewhere between the two estimates, 0.24 to 0.34 μ; that is, 50% of the grain centers lie within 0.12 to 0.17 μ of the disk. By making use of the fact that the distribution is similar in form to a Gaussian probability curve, it may be shown that the frequency distribution descends to half its peak value at 0.21 to 0.30 μ from the source. (P.C.H.)

20509 RADIATION EFFECTS ON ZINC OXIDE CATALYST IN DEHYDROGENATION OF ETHYL ALCOHOL. M. Donato (Dept. of Mines and Technical Surveys, Ottawa). Nature, 194: 969-70(June 9, 1962).

Results are reported of irradiation effects on the catalytic behavior of zinc oxide prepared by ignition of zinc carbonate. Irradiation was found to increase the amount of hydrogen formed by dehydrogenation of ethyl alcohol and to decrease the amount of ethylene formed by dehydration over the temperature range 330 to 390°C. It is concluded that irradiation raises the Fermi level of the catalyst. (D.L.C.)

20510 RADICAL PRODUCTION AND ENERGY TRANSFER IN RADIATION CHEMISTRY AND IN PHOTOCHEMISTRY. Gisela Kallmann Oster and Hartmut P. Kallmann (New York Univ.). Nature, 194: 1033-5(June 16, 1962).

The excited states of benzene that are involved in radical production and energy transfer to CCl_4 were determined by

comparing radical production by optical excitation and by ionizing excitation particularly in the crucial region of low CCl_4 concentration. It was determined that radical production when benzene is irradiated with light in the presence of CCl_4 is caused by energy transfer from the first excited state of benzene to a CCl_4 molecule. Under excitation by ionizing radiation the first electronic state of benzene is also excited, but since this excitation amounts to not more than 3%, its contribution to radical production is insignificant compared to that by higher excited states. (M.C.G.)

20511 PHASE EFFECTS IN THE RADIATION CHEMISTRY OF ORGANIC COMPOUNDS WHICH MAY ARISE FROM LONG-RANGE ENERGY TRANSFER. E. Collinson, J. J. Conlay, and F. S. Dainton (Univ. of Leeds, Eng.). Nature, 194: 1074-5(June 16, 1962).

The gamma-induced destruction of $FeCl_3$, I_2, and DPPH in benzene, diphenyl ether, diphenyl methane, phenetole, p-dioxan, 2-methyl tetrahydrofuran, and diethyl ether was investigated. For all liquid solutions at 30°C, G(S) was independent of solute concentration and dose and showed the expected dependence on solvent structure. Crystalline solutions in diethylether or dioxan and glassy solutions in phenetole or 2-methyl tetrahydrofuran had $G(FeCl_3)$ values which were independent of dose, temperature, and solute concentration, and were smaller than the values for the corresponding liquid solutions. The value of G(S) for crystalline solutions of $FeCl_3$ in the first four solvents and of iodine in diphenyl ether or phenetole was markedly dependent on concentration, increased with diminishing temperature of irradiation and in some cases was much larger than the value in the liquid phase. (M.C.G.)

20512 γ-RADIOLYSIS OF HEXANE IN THE PRESENCE OF SMALL ADMIXTURES OF BENZENE. L. S. Polak, N. Ya. Chernyak, V. A. Skakhray, and A. S. Shcherbakova. Neftekhimiya, 1: 695-9(Sept.-Oct. 1961).

The effect of small amounts of benzene on the process and the basic products of the γ radiolysis of hexane in a liquid phase at 20°C was studied. Since extremely small amounts of benzene influence the γ radiolysis of hexane, special attention was paid to the purity of the initial hydrocarbons. The following results were obtained. During the radiolysis of hexane in the presence of 10^{-4} to 10^{-1} mole/liter of benzene the yield of the various products of radiolysis formed by different mechanisms decreases, as compared with pure hexane, with an increase of benzene concentration to $5 \cdot 10^{-3}$ mole/liter. No further decrease was observed with an increase of benzene concentration up to 10^{-1} mole/liter. The independence of inhibition from the chemical reaction of formation of different radiolysis products may be explained by the fact that the inhibitor takes part of the excitation energy from electron levels of the excited molecules or ions, before any chemical reaction occurs. The transfer of excitation energy from the molecule of irradiated hydrocarbon to the molecule of the inhibitor in the radiolysis of n-hexane with additions of benzene satisfies the relationship corresponding to the direct electromagnetic transfer of energy. (OTS)

20513 DOUBLE QUANTUM TRANSITION IN ELECTRON SPIN RESONANCE OF GAMMA-IRRADIATED ACETYL-d,l-ALANINE. Mikio Katayama (Duke Univ., Durham, N. C.). Phys. Rev., 126: 1440-2(May 15, 1962).

Double quantum transitions were observed at high rf fields in hyperfine spectra of electron spin resonance of the free radical produced by the gamma irradiation of acetyl-d,l-alanine. The presence of interaction between the free radicals give rise to the double quantum transitions. A theoretical explanation is given. (auth)

20514 FORMS OF H AND OH PRODUCED IN THE RADIOLYSIS OF AQUEOUS SYSTEMS. F. S. Dainton and D. B. Peterson (Leeds Univ., Eng.). Proc. Roy. Soc. (London), A267: 443-63(June 5, 1962).

As the pH of an aqueous solution of nitrous oxide is increased from 0.1 to 4, $G(N_2)$ for the γ-irradiated system increases sigmoidally from 0.75 to 3.1 and $G(O_2)$ from 0.1 ± 0.1 to 1.23 while $G(H_2)$ decreases from 0.45 to 0.2 and $G(H_2O_2)$ decreases slightly. At all higher pH values $G(H_2)$ is constant, but $G(N_2)$ and $G(O_2)$ are constant only up to pH 11.2 when $G(N_2)$ increases suddenly by about one unit and $G(O_2)$ possibly undergoes a small increase. These data and the effect of pH on $G(Fe^{3+})$, $G(N_2)$, and $G(H_2)$ for N_2O-containing, de-aerated solutions of ferrous sulfate are explicable in terms of a primary act for γ-irradiated aqueous systems represented by the equation $4.5\ H_2O \xrightarrow[100\ ev]{\gamma}$ $0.45\ H_2 + (0.8 - 0.015\ pH)\ H_2O_2 + (2.05 + 0.03\ pH)\ OH + 2.75\ H_a + 0.75\ H_2O^*$, where H_a is an entity, stoichiometrically equivalent to a hydrogen atom, which can react with N_2O ultimately forming N_2 and an entity stoichiometrically equivalent to a hydroxyl radical. H_a reacts with H^+ to form H_b which reacts with N_2O much more slowly than H_a. H_2O^* is an excited water molecule which can revert to the ground state (lifetime > 10^{-9} s) or react with sulfuric acid to form OH or its equivalent and H_c, equivalent to a hydrogen atom and which can react with N_2O in a manner similar to H_a. All three species, H_a, H_b, and H_c can oxidize ferrous ions and reduce ceric ions in a stoichiometrically equivalent manner. Their possible identities are discussed and it is concluded that probably $H_a = e^-_{aq}$, $H_b = H$, and $H_c = H_2^+$. The postulated existence of H_2O^* gives a rational description of the hitherto unexplained increases in G_{OH} and conventional G_H which occurs at pH < 3.5. The step in the curve of $G(N_2)$ against pH at 11.2 is attributed to ionic dissociation of the hydroxyl radical ($\rightarrow H^+ + O^-$) and the reaction $O^- + N_2O \rightarrow (N_2O_2^-) \rightarrow \frac{1}{2}N_2 + NO_2^-$. (auth)

20515 RADIOCHEMICAL INVESTIGATION OF NUCLEIC ACIDS. S. Apelgot, B. Ekert, Raymond Latarjet, and Nicole Rebeyrotte (Institut du Radium, Paris). Strahlentherapie, 118: 54-66(May 1962). (In German)

Peroxides of thymine, uracil, and cytosine which are more or less unstable, were produced by irradiating nucleic acids in aqueous solutions containing oxygen. After labeling the desoxyribonucleic acid (DNA), the death of E. coli B/r-bacteria which require thymine was found to depend upon the specific activity of the radiothymine in case of C^{14}, upon the temperature in case of H^3 and P^{32}, and (with exception of H^3) seemed to be bound to a transmutation and not to the emitted β radiation. The quantum efficiency of the excitation and ionization for inactivation of the genetic characteristic, "streptomycin-resistance," by transforming DNA of the pneumococcus were recalculated. According to this, ionization is 5200 times more effective than excitation by a photon of 4.9 ev. (auth)

20516 THE EFFECT OF γ-RADIATION ON METHANOL DECOMPOSITION WITH ZINC OXIDE. Naoyuki Todo. Tôkyô Kogyo Shikensho Hôkoku, 57: 160-5(Mar. 1962). (In Japanese)

For the purpose of obtaining information on the effect of radiation on methanol decomposition with zinc oxide catalyst, the catalytic decomposition of methanol was carried out by two methods. In one method, zinc oxide catalyst was irradiated with γ rays prior to the decomposition, and methanol was decomposed with the irradiated catalyst, without irradiation of the reaction system. In the other method, methanol was decomposed under radiation, by use of zinc oxide catalyst which was not irradiated previously.

The activity of the irradiated catalyst decreased as the radiation dose increased up to 2×10^7 r. The decomposition of methanol with this catalyst resulted in a greater amount of methylformate, and the amount of methylformate formed increased with an increase in the radiation dose used in the irradiation of the catalyst. The electrical conductivity of the irradiated catalyst slightly increased with the radiation dose, whereas the specific surface area was not affected by irradiation. However, when the irradiated catalyst was heated at 400°C for 3 hrs, the catalyst showed the same activity and electrical conductivity as were found before irradiation. In the catalytic methanol decomposition carried out under γ radiation, the rate of total decomposition of methanol was increased and the yield of methylformate decreased, as the radiation dose was increased. It, therefore, seemed likely that the main role of γ radiation in this reaction is to promote the decomposition of formaldehyde produced as an intermediate. (auth)

20517 DECOMPOSITION OF AROMATIC SUBSTANCES BY DIFFERENT KINDS OF RADIATION. PART I. PROTON IRRADIATION OF BENZENE. W. G. Burns (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Trans. Faraday Soc., 58: 961-70(May 1962).

Pure benzene was irradiated at 20 to 25°C with protons of energies from 3.88 down to 0.69 Mev. The only decomposition gases were hydrogen and acetylene. The G values increased with decreasing energy from 0.066 to 0.11 for hydrogen, and from 0.033 to 0.063 for acetylene. The polymer G value, i.e., G (-benzene) did not vary significantly with the proton energy, and the mean value was 1.09. Some implications of the results are discussed. (auth)

20518 EFFECT OF IONIZING RADIATION ON POLYETHYLENE INSULATION. V. L. Karpov, Yu. M. Malinskii, L. V. Mitrofanova, S. T. Sinitsyn, E. E. Finkel, A. S. Fridman, and S. M. Chernetsov. Trudy Tashkent. Konf. po Mirnomu Ispol'zovan. At. Energ., Akad. Nauk Uzbek, S.S.R., 1: 383-9(1961).

The effect of ionizing radiations on the properties of polyethylene was studied. Wires consisting of a copper conductor 1 mm in diameter, insulated by a layer of polyethylene 0.5 mm thick, were irradiated with various doses. The properties of the irradiated insulation were studied, particular attention being devoted to the thermal stability of the insulation, which was evaluated on the basis of thermomechanical curves plotted with the use of a special device. It was shown that irradiation permits the service temperature of the insulation to be increased and that deformation at higher temperatures decreases with an increase in the radiation dosage. The optimum irradiation conditions were found to be 100 to 150 Mrad for a γ source and 2 to 4 min, 1 mv, and 15 μamp/cm^2 for electrons. Wires irradiated under these conditions can serve for several hours at 230 to 250°C and for hundreds of hours at 110°C. Irradiation increases the reliability of the insulation under normal service conditions. The tensile strength, low-temperature resistance, electrical strength, and dielectric properties of insulation irradiated under optimum conditions were found to be fully adequate. It is expected that the properties of polyethylene insulation can be further improved by using certain stabilizing agents. (OTS)

20519 REDUCTION OF CARBONIC ACID IN AQUEOUS SOLUTION UNDER THE EFFECT OF UV LIGHT. Nikola Getoff (Institut für Radiumforschung und Kernphysik der Österr. Akademie, Wissenschaften, Vienna). Z. Naturforsch., 17b: 87-90(Feb. 1962). (In German)

The reduction of aqueous carbonic acid in the pH range 3 to 8.7 under irradiation with UV light was investigated. Carbon monoxide, aldehyde, and formic acid were detected as the reduction product of carbonic acid. The aldehyde formation was studied as a function of irradiation time at various pH values. Some velocity constants for aldehyde formation were calculated, which decreased with the increase of the pH value. The presence of ferro ions leads to an increase in the yield of the materials formed. Some probable reaction mechanisms for the reduction of the carbonic acid in aqueous solution and the formation of organic substances were given. (tr-auth)

20520 APPLICABILITY OF THE APPROXIMATE RADIOLYSIS MODEL TO REACTIONS OF HYDROGEN, OXYGEN AND HYDROGEN PEROXIDE IN AQUEOUS SOLUTIONS. B. V. Ershler and G. G. Myasischcheva. Zhur. Fiz. Khim., 36: 726-33(Apr. 1962). (In Russian)

The reaction mechanism in irradiations of H_2, O_2, and H_2O_2 solutions was examined in terms of the approximate Allen radiolysis model and on the basis of several different works. The mechanism, involving eight reactions, was used in deriving equations for the radiolysis kinetics and the stationary states of the solutions. The expressions obtained are in good agreement with numerous experimental data of different workers. The approximations assumed for the model are discussed and conditions are indicated when they introduce larger or smaller errors in the calculations. A study of the $I^{1/2}$ relation allows the approximate model to be ascertained to various solutions. The existence of such a relation was demonstrated for H_2O_2 solutions not containing H_2 and O_2. The available data on the radiolysis of H_2, O_2, and H_2O_2 solutions may be interpreted without supposing the formation of two types of reducing radicals in the radiolysis of water. (auth)

20521 DATA ON THE RECOMBINATION OF RADICALS OF VARIOUS TRACKS DURING RADIOLYSIS UNDER HOMOGENEOUS KINETICS CONDITIONS. B. V. Ershler and V. M. Byakov. Zhur. Fiz. Khim., 36: 913-15(Apr. 1962). (In Russian)

A simplified Allen's model is used for determining initial radiolysis without using numerical calculations with arbitrary constants and considering recombination of radicals. It is assumed that in the simplified model the initial product of aqueous radiolysis does not depend on concentration and the nature of the acceptor and that the equations of homogeneous chemical kinetics are applied to the primary product reactions with the acceptors and with each other. (R.V.J.)

20522 RADIATION CHEMISTRY OF POLYMERIC SYSTEMS. Adolphe Chapiro. High Polymers. A Series of Monographs on the Chemistry, Physics, and Technology of High Polymers. Volume XV. New York, Interscience Publishers, 1962. 728p. $21.00

Development of the radiation chemistry of polymeric systems is described. Topics covered include: physical data on ionizing radiation, primary radioinduced chemical processes, radioinduced chemical reactions in hydrocarbons, general aspects of radiation-initiated polymerization, radioinduced polymerization of pure monomers in the homogeneous liquid-phase, radioinduced polymerization of pure monomers in heterogeneous phase, radioinduced polymerization of vinyl monomers in the presence of added substances, general aspects of radiation effects in solid polymers, radiation effects in polymers of the cross-linking type, radiation effects in polymers of the degrading type, irradiation of polymer solutions, and preparation of graft copolymers with the aid of ionizing radiations. (M.C.G.)

20523 THE RADIATION POLYMERIZATION OF COMPOUNDS BEARING TWO TERMINAL DOUBLE BONDS.

Roger Dale Caldwell, Thesis. Lawrence, University of Kansas, 1960. 43p.

The radioinduced gelation of several compounds and varying mixtures of compounds with two terminal double bonds each was studied. Clear gelatin capsules were used for irradiation cells. A 100-c Co^{60} source was used for irradiation of the monomers. The five compounds used were ethylene dimethacrylate (EDMA), triethylene glycol dimethacrylate (TEDMA), diallyfumarate (DAF), allyl-methacrylate (ALLM), and divinyl benzene (DVB). Results are presented in graph and table form. It was demonstrated that the gel point can be a useful measure of the polymerization involved in an organic liquid by ionizing radiation. (M.C.G.)

20524 INITIATION AND PROMOTION OF IONIC REACTIONS. (to Continental Oil Co.). British Patent 898,015. June 6, 1962.

A chemical conversion process is given for effecting an ionic chemical reaction which is not effected by radiolysis alone. The process comprises irradiating the gaseous reactants in the presence of a noble gas. Examples of the process are given in which methane, cyclopropane, methylcyclopentane, and methane + propene are irradiated in the presence of xenon. (D.L.C.)

Raw Materials and Feed Materials

20525 (MCW-1472) PROCESS DEVELOPMENT QUARTERLY PROGRESS REPORT JANUARY–MARCH 1962. (Mallinckrodt Chemical Works. Uranium Div., Weldon Spring, Mo.). May 1, 1962. Contract W-14-108-eng-8. 60p.

In gas chromatography a new detector system was developed which enables faster and more sensitive analyses of hexane for impurities (i.e., benzene and higher hydrocarbons) and of sewer water for hexane contamination. A technique was developed for greatly extending the useful analytical range of spectral lines subject to strong self-reversal. As applied to the determination of Na between 10 and 1500 ppm, precision and accuracy are comparable to those of earlier methods. Calibration of an apparatus for surface area determination by the dynamic method and the development of an empirical relationship between stream composition and detector response are reported. Further laboratory work on the electrolytic reduction of uranium oxide is reported. Direct feeding of uranium dioxide to the cell, current efficiency studies, and methods for controlling an electrically conducting scum are discussed. Data from electrical conductivity measurements on molten electrolytes containing various proportions of lithium fluoride, barium fluoride, and uranium tetrafluoride at 1150°C are reported. A rapid procedure and the instrumentation are described for the routine determination of water in uranium tetrafluoride. Off-gases from plant dingot bombs were analyzed by the mass spectrometer throughout the course of the reaction. The gas composition changes were similar to those found in earlier experiments on plant derby bombs and laboratory dingot bombs. X-ray-diffraction measurement of orientation in alloyed dingot-uranium which had been gamma-extruded revealed near random structures in the axial direction. (auth)

20526 STUDY OF THE ACID LEACHING OF URANIUM MINERAL OF THE "LA ESPERANZA" MINE (SALAMANCA). J. Vera Palomino, A. Bellido González, and F. Palomares Delgado (Junta de Energia Nuclear, Madrid). Anales real soc. espãn. fís. y quím. (Madrid), Ser. B, 58: 35-52(Jan. 1962). (In Spanish)

Statistical verifications were made of the homogeneity of the mineral lot used for research, the optimum for leaching for the reagent concentration, and temperature, time, and oxidant concentration as deduced by means of factorial tests and analysis of variances. The course of the main impurities is followed during the process of leaching of raw and calcined mineral. An empirical equation was deduced, which relates the percentage of dissolved uranium E, the H_2SO_4 concentration C, and the temperature T

$$E = \frac{(C - 0.2) \times 10^4}{(40 - 1.2T) + (162 + 7.15T)C} + \frac{10^4 \log T}{315} + 25.6$$

which is valid for H_2SO_4 concentrations between 0.2 and 0.4N, and at 20 to 60°C, from 30 min of leaching onward. (auth)

20527 ELECTROLYTIC PRODUCTION OF URANIUM METAL FROM URANIUM OXIDES. R. D. Piper and R. F. Leifield (Mallinckrodt Chemical Works, St. Charles, Mo.). Ind. Eng. Chem., Process Design Develop., 1: 208-12(July 1962).

Massive uranium metal which exceeds AEC specifications for purity was produced with nearly 100% recovery from uranium oxides. Electrolysis at 1150°C in a fused fluoride electrolyte produces molten metal. Oxides are excluded from the metal product to obtain well coalesced metal, by incorporating the oxide to be reduced in a consumable uranium oxide–carbon anode. Means of preparing uranium oxide–carbon anodes with electrical resistivities of less than 0.03 ohm-cm were found. Cell designs amenable to continuous operation were developed on a laboratory scale. (auth)

20528 HYDROGEN REDUCTION OF URANIUM OXIDES. A PHASE STUDY BY MEANS OF A CONTROLLED-ATMOSPHERE DIFFRACTOMETER HOT STAGE. K. J. Notz, C. W. Huntington, and Winston Burkhardt (National Lead Co. of Ohio, Cincinnati). Ind. Eng. Chem., Process Design Develop., 1: 213-17(July 1962).

The successive phase changes which occur during the hydrogen reduction of uranium oxides were studied in situ by means of a controlled-atmosphere x-ray diffractometer hot stage at 480 and 750°C. The phase sequence which occurred during reduction of γ-UO_3, the most stable allotrope of UO_3, was γ-UO_3 (orthorhombic) $\xrightarrow{1}$ U_3O_8 (hexagonal) $\xrightarrow{2}$ U_3O_8–(orthorhombic) $\xrightarrow{3}$ UO_{2+} (cubic) $\xrightarrow{4}$ UO_2 (cubic). The upper compositional limit of the nonstoichiometric phase, UO_{2+}, was greater at the higher reduction temperature, in agreement with the equilibrium phase diagram. When starting with U_3O_8, reactions 2, 3, and 4, as given above, were observed. In conjunction with this work, β-U_3O_8 was prepared and found to revert endothermically to conventional U_3O_8 at about 130°C. (auth)

20529 CALCINATION AND SINTERING STUDY OF THORIA. Y. Harada, Y. Baskin, and J. H. Handwerk (Argonne National Lab., Ill.). J. Am. Ceram. Soc., 45: 253-7(June 1962).

Data on the effect of calcination temperature on surface area, apparent crystallite size, compactibility, sintered density, and volume shrinkage are presented for thoria prepared from the oxycarbonate, chloride, nitrate, and oxalate. Surface area and volume shrinkage decreased with rising calcination temperature. Thoria obtained from the oxycarbonate exhibited the greatest sinterability; material derived from the nitrate showed the least. Maximum bulk densities were achieved using material resulting from the calcination of the oxycarbonate between 600 and 1000°C. Densities of 95 to 98% of the theoretical value of thoria were attained by compacting these powders at pressures above 20 tsi and firing at 1500°C for 24 hours. Urania-thoria solid solutions incorporating thoria obtained by cal-

cination of the chloride exhibited the highest fired densities. (auth)

20530 THE PRODUCTION OF URANOUS DOUBLE FLUORIDES AND THEIR SUBSEQUENT REDUCTION TO URANIUM METAL. C. W. A. Muir. J. S. African Inst. Mining Met., 62: 519-37(Apr. 1962). (In English)

The design and operation of a pilot plant for the continuous production of sodium uranous fluoride is described. Special consideration is given to the choice of materials of construction, since one of the major difficulties encountered was the contamination by the products of corrosion of various metallic materials. Failure to produce massive uranium metal from the sodium salt led to the batchwise production of the ammonium salt which was calcined to form uranium tetrafluoride from which metal was produced. (auth)

20531 CONTINUOUS PROCESS FOR PREPARING URANIUM HEXAFLUORIDE FROM URANIUM TETRAFLUORIDE AND OXYGEN. (to U. S. Atomic Energy Commission). British Patent 897,793. May 30, 1962.

A large-scale process is given for preparing UF_6 from impure UF_4 without the use of F_2. The process gives high yields and avoids problems from UF_4 sintering and formation of intermediate fluorides. The process comprises continuously introducing finely divided dry UF_4 and dry O_2 into a bed of dry UO_2F_2 under fluidization conditions, maintaining the bed at 600 to 900°C and at a UF_4 concentration less than 25 wt %, continuously removing the solids from the top of the bed, and recovering the UF_6 gas. Apparatuses for conducting the process, some of which recycle UO_2F_2 or off-gases, are described. (D.L.C.)

20532 PRODUCTION OF THORIUM–URANIUM ALLOYS. (to Atomic Energy of Canada Ltd.). British Patent 898,141. June 6, 1962.

A process is given for producing Th–U alloys. The process comprises mixing Th metal particles with UF_4, heating the mixture in a vacuum or an inert gas in a graphite crucible to initiate reaction between Th and UF_4, continuing the heating to ≥1600°C to form an alloy phase and a slag phase, cooling the products, and separating the slag from the alloy. The slag protects the alloy from oxidation and reaction with the crucible. (D.L.C.)

20533 IMPROVEMENTS IN OR RELATING TO THE PRODUCTION OF METALS. John Syme Nairn and Roland Taylor (to United Kingdom Atomic Energy Authority). British Patent 899,406. June 20, 1962.

A method is given for producing U and Pu metal. The method comprises reducing the trihalide of the metal with an alkali metal in an organic solvent in which the halide and alkali metal are soluble, consolidating the precipitate of alkali metal halide and metal powder, and separating the metal from the alkali metal halide by vacuum melting or other suitable methods. In the preferred embodiment of the method, Na–K alloy and U or Pu trichloride are dissolved in separate portions of tetrahydrofuran containing 2 to 3% diphenyl, and reaction is initiated by mixing together the two solutions. (D.L.C.)

Separation Processes

20534 (IDO-14574) CHEMICAL PROCESSING TECHNOLOGY QUARTERLY PROGRESS REPORT, JULY–SEPTEMBER 1961. J. R. Bower, ed. (Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho). Dec. 18, 1961. Contract AT(10-1)-205. 55p.

The processing plant did not operate on fuel recovery during the period since numerous repairs and modifications were being made to the extraction and U concentration equipment. Ba^{140} production continued on schedule; substantial decontamination of the RaLa facility was achieved and desirable replacement or repair of in-cell equipment was accomplished in the interval between two successive runs. Aqueous Zr fuel processing studies continued with the objective of adapting the HF process to continuous dissolution and complexing in order to increase the capacity of the ICPP process while using as much existing equipment as possible to minimize costs. Dissolution rates for Zircaloy-2 in 10M fluoride dissolver solution proved to be adequate for continuous dissolution (as high as 79 mg cm^{-2} min^{-1}) in an acid range which resulted in both controlled gas evolution and stable dissolver solutions. Preliminary results indicate the possibility of blending Zr raffinates from this process with larger volumes of Al raffinates to achieve stable waste solutions and avoid the necessity of constructing additional special alloy tanks for Zr waste. Supplemental studies on the sodium formate process for head end precipitation of Zr and fluoride are reported, as well as results of corrosion tests on materials of construction considered for use in various zirconium processing applications. Other aqueous processing studies included the determination that 2.2M aluminum nitrate solutions, acid deficient to 1.0N[b], could be used to scrub highly acid U extraction solutions without incurring the hazard of ammonium diuranate precipitation. Preliminary to processing organic moderated reactor fuel elements it was discovered that carbonaceous films present on some elements were resistant to removal by Turco 4502 solution, and responded only to oxidation at 500°C; the possibility of processing without film removal was explored with satisfactory results insofar as dissolution of the fuel is concerned. Electrolytic dissolution of nichrome-containing fuels in HNO_3 appears promising and conditions predicted from earlier studies on stainless-steel dissolution were confirmed. Stability, density, and viscosity data are presented for representative product solutions from electrolytic dissolution of stainless-steel fuel of the APPR type. Results of additional chemical and radiation exposure tests on possible plastic insulator materials are presented. Factors affecting the formation of alpha alumina from amorphous alumina received additional study in the laboratory because of the severe attrition problem and related operational difficulties associated with the alpha form in the fluidized-bed calcination process. It was demonstrated that very little alpha alumina was formed by heating amorphous pilot plant product in air, moderate amounts were formed by heating in an air-water vapor atmosphere, and larger amounts were formed when the atmosphere also contained HNO_3 vapors. Temperature and method of alumina formation (i.e., conditions of pilot plant calciner operation) also affected the conversion but appeared to be interrelated so that no clear cut conclusion on individual effects could be drawn. Investigations of intermediates in the reaction, and structure and distribution of crystalline material in individual particles of calcine, are discussed. Pilot plant calcination studies showed a direct effect between feed Na content and alpha alumina formation rate. Hg was found to have no detectable effect on the process or product. Stripping of TBP from aqueous U streams was investigated because of difficulty associated with decomposition products of TBP, which form gummy deposits and interfere with the operation of product evaporators and pumps. Using tracer P, the TBP distribution coefficient between Amsco and water containing flowsheet quantities of HNO_3 and U was found to be sufficiently high (290 ± 31) that stripping with Amsco should have presented no problem. However, an inextractable P species was detected. This species formed under the influence of hydrolysis, radioly-

sis, or both, and limited P removal to a TBP equivalent of 1×10^{-3} g/l. Other basic process studies reported include analog simulation of air pulsers, dynamics of a new thermosiphon evaporator, and background information on extraction column kinetics. (auth)

20535 (IDO-14583) CHEMICAL PROCESSING TECHNOLOGY QUARTERLY PROGRESS REPORT, OCTOBER–DECEMBER 1961. J. R. Bower, ed. (Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho). Mar. 28, 1962. Contract AT(10-1)-205. 51p.

The ICPP processed Al fuel, principally of the MTR-ETR type, during this quarter. Newly designed and installed processing equipment exhibited excellent operating performance. This included direct-air-pulsed extraction, stripping and scrub columns, and a cascade-controlled continuous evaporator in first cycle product concentration service. Aqueous zirconium fuel processing studies continued with the objective of adapting the hydrofluoric acid process to continuous dissolution-complexing to increase the capacity of the ICPP process while using as much existing equipment as possible to minimize costs. Six variations of hydrofluoric acid flowsheets were tested in a small-scale continuous dissolvers. Dissolution rates were found to be high in all cases and dissolution was easily initiated at temperatures as low as 30°C. Monel and Carpenter-20(Nb) were found to be satisfactory construction materials, from the standpoint of corrosion, if oxidizing conditions were carefully controlled. Additional studies are reported on the stability of blended Zr and Al process raffinates and on the nature of the solids which result from the sodium formate headend precipitation process. Electrolytic dissolution studies, directed at fundamentals of current utilization in a "series"-type dissolver, demonstrated that high current utilization is obtained when the polarization resistance is small compared with the solution resistance. Factors affecting polarization resistance and solution resistance are clarified. A decrease in current utilization observed with alternating current as compared with direct current may be offset by efficiencies in elimination of a-c–d-c converters required for the d-c system. Experimental results indicate the possible usefulness of several plastic and ceramic materials in the chemical and radiation environment of an electrolytic dissolver. Fluidized bed calcination tests conducted in pilot plant and demonstrational waste calcination facility calciners demonstrated that alpha alumina formation was suppressed by addition of boric acid to the waste aluminum nitrate feed. A possible relationship between nozzle design and alpha alumina formation also was noted. Additional laboratory studies on the effect of environmental gas composition on alpha alumina formation were conducted, and pilot plant investigation of calciner off-gas particulate loading demonstrated the effects of nozzle operating conditions on particle attrition. Pulse column development continued with the goal of specifying and evaluating column control requirements through a study of pulse column dynamics. Use of porous Kel-F and porous stainless steel has provided means of separating and sampling the organic and aqueous phases from the experimental column. Pulse amplitudes in an experimental air pulser were measured by electronic integration of a signal representing the square root of the output of a flow transducer in the pulser leg. Results of calibration runs agree to within 5% of the amplitude observed in a glass pulser leg, and, for comparable conditions, to within 2 to 3% of values obtained by simulation on an analog computer. Additional basic process studies reported include an investigation of the distribution of U between TBP-Amsco and HNO_3 solutions as found in stripping and scrub column conditions and as influenced by the presence of dibutyl phosphate, a TBP degradation product. Other basic studies involve development of a continuous recirculating dissolver, study of the effect of Si in Al alloy fuels on U losses, and determination of ion exchange properties and possible usefulness of local natural earth materials in low-level waste treatment. (auth)

20536 (ORNL-2712) DAREX PROCESS: PROCESSING OF STAINLESS STEEL-CONTAINING REACTOR FUELS WITH DILUTE AQUA REGIA. F. G. Kitts and W. E. Clark (Oak Ridge National Lab., Tenn.). June 7, 1962. Contract W-7405-eng-26. 101p.

The Darex process developed for the recovery of U from stainless steel-containing reactor fuels consists of dissolution of the fuel material in dilute aqua regia, removal of chloride from the solution to prevent corrosion of downstream stainless steel process equipment, and adjustment of the nitrate solution to solvent extraction feed conditions. Each step can be either continuous, semi-continuous, or batch with continuous operation showing much higher throughput for comparable equipment. The preferred dissolvent is 5 M HNO_3-2 M HCl, since dissolution rates and metal loadings are near maximum. Nitric acid from 60 to 95 wt % can be used in decreasing the chloride concentration to <350 ppm; the higher strength acids have process advantages. Excess nitric acid is recovered and recycled during production of a concentrated metal-salt solution, which is diluted to Purex solvent extraction feed acidity, 2-3 M HNO_3. Titanium is a satisfactory material of construction, with corrosion rates <1 mil/mo in all process environments and over-all heat transfer coefficients comparable to those of stainless steel. (auth)

20537 (ORNL-TM-177) CHEMICAL TECHNOLOGY DIVISION, CHEMICAL DEVELOPMENT SECTION B, QUARTERLY PROGRESS REPORT, OCTOBER–DECEMBER, 1961. R. E. Blanco (Oak Ridge National Lab., Tenn.). May 18, 1962. Contract [W-7405-eng-26]. 92p.

Developments are reported on graphite fuels, carbide fuels, B and BeO fuels, chloride volatility processes, solvent extraction, vicor glass adsorption, Zirflex process demonstration, elimination of Si in the Darex process, corrosion studies, activity coefficients of HNO_3, foam separation, high- and low-level waste treatment, fission product recovery by ion exchange, radiation damage to ion exchange resins, and chemical applications of nuclear explosions. (J.R.D.)

20538 (ORNL-TM-186) CORROSION OF THE VOLATILITY PILOT PLANT INOR-8 HYDROFLUORINATOR AND L NICKEL FLUORINATOR AFTER 21 NONRADIOACTIVE DISSOLUTION RUNS. E. C. Moncrief (Oak Ridge National Lab., Tenn.). Mar. 29, 1962. Contract [W-7405-eng-26]. 10p.

Excessive corrosion of an instrument line in the Volatility Pilot Plant hydrofluorinator was observed after 21 processing runs with prototype and unirradiated zirconium–uranium fuel. Maximum and average corrosion rates for the pipe were 0.10 and 0.01 mil per HF exposure hour, respectively. Examination of the hydrofluorinator and fluorinator vessel walls by ultrasonic techniques did not show abnormal corrosion. Average corrosion rates for these vessels after 503 hr of HF and 38.7 hr of F_2 exposure were 0.01 to 0.03 and 0.12 to 0.26 mil per gas exposure hour, respectively. These rates, based on uncleaned vessel surfaces, are lower than previous measured rates. (auth)

20539 (ORNL-TM-246) EUROCHEMIC ASSISTANCE PROGRAM. Progress Report for July 1961 through June 1962. R. J. Sloat and E. M. Shank (Oak Ridge National Lab., Tenn.). July 2, 1962. Contract [W-7405-eng-26]. 7p.

The Eurochemic staff was expanded to about 160 people. The plant design capacity remains as previously reported, but changes were authorized within the plant to permit processing of enriched fuels. The pre-project design was completed for all facilities approved by the Board. The pre-project design for the enriched uranium processing annex is essentially complete. Over-all detailed design is about 40% complete, and construction is about 10% complete. The plutonium tail-end flowsheet now envisioned will use a 10% TLA extraction followed by direct precipitation from the organic by H_2O_2. The enriched uranium process flowsheet will use a dilute TBP solvent in the low-enrichment plant followed by two geometrically safe designed solvent extraction cycles. Development effort includes pilot plant scale dissolution studies of the Zirflex, Sulfex, and H_2SO_4–Mg decladding processes, pulse column runs at the Kjeller pilot plant using feeds 40 times more radioactive than previous laboratory-scale runs, and waste evaporator studies. (auth)

20540 (UCRL-10048) SEPARATION OF IMMISCIBLE LIQUIDS BY GRAVITY SETTLING AND INDUCED COALESCENCE. PART I: HORIZONTAL GRAVITY SETTLERS. PART II: GRAVITY SETTLING WITH INDUCED COALESCENCE (thesis). Robert J. Graham (California. Univ., Berkeley. Lawrence Radiation Lab.). Feb. 5, 1962. [Contract W-7405-eng-48]. 91p.

The separation of water from Aroclor 1248 by use of gravity settlers was investigated. The water concentration in the effluent Aroclor was found to depend on several factors, including the inlet and baffle positions, the initial water concentration, and the degree of turbulent mixing upstream from the settler, as well as on the Aroclor flow rate and depth, and the settler length. At high flow rates, an emulsion of water and Aroclor droplets formed at the Aroclor-water interface. This emulsion influenced the water concentration in the effluent Aroclor. Although the general influence of these factors on the separation of water from Aroclor 1248 was established, it was not possible to correlate them in designing full-scale gravity settlers from laboratory-scale settlers. Fiberglas coalescers mounted in the settlers were effective in coalescing the emulsion and removing Aroclor droplets from the water layer. The coalescers with the most surface area were the most efficient in removing water from the Aroclor. Pressure drops through the coalescers were negligible. (auth)

20541 (EURAEC-24) RETREATMENT OF SPENT FUELS. Quarterly Report No. 2 (3rd Quarter 1960). (Brussels. Centre d'Étude de l'Énergie Nucléaire). 1960. Work Performed under United States–Euratom Joint Research and Development Program. Contract [008-60-4RDB]. 134p. A Translation.

The reactions of uranium carbide with carbonic anhydride and carbon dioxide were studied under different conditions. The influence of oxydo-reduction cycles on the reactivity of sintered oxide was the object of a thermo-gravimetric study using a reaction temperature increasing linearly with time. Reactivity variations and the formation of U_3O_7 at a low temperature were revealed. Kinetics of sintered UO_2 oxidation and U_3O_8 reduction were studied. Information was obtained, in a study of fluidization, on pressure drop, the height of the bed, screen analysis, the presence of rigid obstacles in the bed, dead angles of fluidization, distribution of temperature, the rheology of powders, and the fraction of vacuum. Different methods of heating the gases in fluidized beds were tested, and the behavior of the base and dust extracting filters were studied. The systems of heating and thermostatization, automation of dust extraction and sampling of the powders were perfected. The construction of a UF_6 distillation column was begun. Work is continuing on perfecting the installation for chromatography in the vapor zone. Prototype test in the plutonium process led to the conception of a different type of thermobalance. (M.C.G.)

20542 (TRG-Inf-Ser-42) EFFECT OF THE DILUENT ON THE EXTRACTION OF URANYL NITRATE BY TRIBUTYL PHOSPHATE. M. F. Pushlenkov, E. V. Komarov, and O. N. Shuvalov. Translated from Radiokhimiya, 2: 537-46 (1960). 8p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 15, as abstract No. 5128.

20543 SEPARATION OF RARE EARTHS FROM A SPANISH MINERAL BY ION-EXCHANGE METHODS. M. Angoso, S. Amer, F. de la Cruz, and R. F. Cellini (Junta de Energia Nuclear, Madrid). Anales real soc. espãn. fís. y quím. (Madrid), Ser. B, 58: 29-34(Jan. 1962). (In Spanish)

Rare earth elements have been obtained in a high-purity state by ion-exchange methods from a Spanish mineral. The cracking of the mineral was done by boiling with HCl. Cerium was removed by oxidation with potassium permanganate. Concentrates of rare earths were prepared by breaking up the rare earth–EDTA complexes with HCl in the presence of oxalic acid. Fractionation of the rare earths was carried out by eluting with EDTA from a Dowex-50 bed. (auth)

20544 THE PRODUCTION OF CARRIER-FREE ^{132}Te, ^{132}I, ^{99}Mo, and ^{99m}Tc FROM NEUTRON-IRRADIATED URANIUM BY FRACTIONATED SORPTION ON ALUMINIUM-OXYDE. W. D. Tucker (Brookhaven National Lab., Upton, N. Y.), M. W. Greene, and A. P. Murrenhoff. Atompraxis, 8: 163-7(May 1962). (In German). (BNL-5507).

Methods for the production of carrier-free Te^{132}, I^{132}, Mo^{99}, and Tc^{99m} are described. They are distinguished by their simplicity and efficiency and are therefore especially suited for the separation of higher activities in hot cells. The methods are in use in the Brookhaven National Laboratory for the routine production of the above-listed radionuclides. The development of the described methods was initiated in a connection with work on further improvement of the preparation of carrier-free I^{132} in the Brookhaven generator. (auth)

20545 THE EXTRACTION OF ZIRCONIUM AND HAFNIUM FROM SOLUTIONS CONTAINING NITRIC AND HYDROCHLORIC ACID. A. M. Reznik, A. M. Rozen, S. S. Korovin, and I. A. Apraksin (Moscow State Univ.). Doklady Akad. Nauk S.S.S.R., 143: 1413-6(Apr. 21, 1962). (In Russian)

The extraction coefficient for the extraction of Zr and Hf by 50% tri-n-butylphosphate (TBP) in o-xylol depends on the concentration of metal in the aqueous phase and on the ratio of HNO_3 to HCl at a total acidity of 5 mol/l. An apparent extraction constant $\tilde{K} = \alpha/A^4T^2$ was calculated from the reaction: $Me^{4+} + 4A^- + 2TBP \rightleftharpoons MeA_4 \cdot 2TBP$. Here, α is the distribution coefficient, Me is Zr or Hf, A^- is the concentration of the anion (Cl^- or NO_3^-) in mol/l, and T is the concentration of free TBP. The apparent extraction constant $\tilde{K}$ falls off rapidly at low concentrations of Zr and Hf due to polymerization of the metal in the aqueous phase. If it is assumed that the polymerization goes by a chain mechanism ($A_1 + A_n \overset{K_n}{\rightleftharpoons} A_{n+1}$, where n = 1, 2, 3 ....) and that all the K_n constants are the same; it is found that K_n for Zr ≈ 8 and K_n for Hf ≈ 29 in HNO_3 and that K_n for

Zr ≈ 13 and K_n for Hf ≈ 3 in HCl. In mixtures of HNO_3 and HCl an increase in the extraction coefficient is observed due to the formation of nitrato-chloride Zr and Hf complexes. Direct analyses of the organic phase showed the existence of complexes such as $Zr(NO_3)_3Cl \cdot 2TBP$ and $Zr(NO_3)_2Cl_2 \cdot 2TBP$. Corrections had to be made for the increase in activity coefficient of Zr in the aqueous phase on the addition of chloride ion. On replacing HNO_3 by HCl the distribution coefficient for Zr goes through a maximum and that of Hf decreases. This behavior can be used to separate Zr and Hf. (TTT)

20546 SEPARATION OF RARE EARTHS BY COLUMN CHROMATOGRAPHY WITH CELLULOSE POWDER TREATED WITH DI(2-ETHYLHEXYL) ORTHOPHOSPHORIC ACID. PART I. E. Cerrai, C. Testa, and C. Triulzi (CISE, Milan). Energia nucleare (Milan), 9: 193-9(Apr. 1962). (In English)

The possibility of separating mg amounts of rare earths from each other, by the use of cellulose powder treated with the cationic exchanger di(2-ethylhexyl)orthophosphoric acid (HDEHP) was demonstrated. The exchange capacity of the cellulose was determined as a function of the concentration of the HDEHP solution. By means of the separation of Eu-Tb the average separation factor for two adjacent lanthanides was determined. The separations Eu-Y-Yb, Sr-Ce-Eu-Y-Yb, and Cs-Sr-Ce-Tb-Yb are reported as examples. (auth)

20547 ROLE OF THE PACKING IN A SCHEIBEL EXTRACTOR. J. R. Honekamp and L. E. Burkhart (Iowa State Univ., Ames). Ind. Eng. Chem., Process Design Develop., 1: 176-84(July 1962). (IS-202).

Drop size in a Scheibel extractor is determined by drop size in the mixing sections. Very little change in average drop size takes place in the packing. The amount of extraction in Yorkmesh packing was measured by using a sampling technique developed to obtain point concentrations of both streams inside the column. Drop size and hold-up in a Scheibel column at constant stirrer speed closely paralleled that of a packed column. Stirrer speed had a marked effect on transfer area and concentration gradient in the packed sections. The magnitude of these effects was determined for the methyl isobutyl ketone–acetic acid–water system in a four-stage Scheibel extractor. (auth)

20548 THE DISTRIBUTION OF HEXAVALENT URANIUM BETWEEN ALCOHOL–NITRIC ACID SOLUTIONS AND THE STRONGLY BASIC EXCHANGER DOWEX-1. J. Korkisch and F. Tera (Analytical Inst. of the University, Vienna). J. Chromatog., 7: 564-7(Apr. 1962). (In English)

The adsorption of uranium from HNO_3 solutions containing aliphatic alcohols was investigated. The anion exchanger Dowex-1 was used. It was found that the absorption of the uranium nitrate complex on the resin is highest in an amyl alcohol medium and lowest in methanol medium. The adsorption of uranium at higher percentages of alcohol increased with increasing chain length of the alcohol employed. (M.C.G.)

20549 SEPARATION OF RARE EARTHS ON ANION-EXCHANGE RESINS. III. THE POSITION OF SCANDIUM IN THE SEPARATION SCHEME OF RARE EARTH COMPLEXES WITH ETHYLENEDIAMINETETRAACETIC ACID. Jerzy Minczewski and Rajmund Dybczyński (Inst. of Nuclear Research, Polish Academy of Sciences, Warsaw). J. Chromatog., 7: 568-9(Apr. 1962). (In English)

The elution behavior of scandium in the system of Amberlite IRA-400[H_2Y^{2-}]-Na_2H_2Y aq. was checked. Distribution coefficients were calculated. (M.C.G.)

20550 SEPARATION OF INORGANIC IONS IN FUSED SALTS BY ELECTROPHORESIS ON GLASS FIBER PAPER. G. Alberti, G. Grassini, and R. Trucco (Comitato Nazionale per l'Energia Nucleare, Rome). J. Electroanal. Chem., 3: 283-5(Apr. 1962).

The possibility of separating various inorganic ions by means of electrophoresis in fused salts, employing glass fiber paper as the support, was investigated. Electrophoresis was carried out in a pyrex glass oven. It was found that some separations are possible. (M.C.G.)

20551 CHEMICAL SEPARATION OF INDIUM^{111} FROM CADMIUM TARGETS AFTER PROTON IRRADIATION WITH A CYCLOTRON. Ursula Drehmann and Uta Puerschel (Inst. of Nuclear Physics of the Research Assn. of Scientific, Technological, and Medical Institutes, German Academy of Sciences, Berlin). J. prakt. Chem., 14: 66-70 (1961).

In^{111} of high chemical purity, required for angular correlation measurements of its γ-cascade, was obtained according to the reaction $Cd^{111}(p,n)In^{111}$ by four-hour irradiation of Cd sheet with protons. In^{111} was separated from Cd after the dissolution of the irradiated sheet in concentrated HNO_3 by co-precipitation of In^{111} on an $In(OH)_3$ deposit from natural In, and by electrolytic deposition of In after twofold reprecipitation (activity yield: 90%). Other methods considered proved unsuited for the preparation of chemically pure In^{111} (from Ag by α-irradiation or from Cd by d-irradiation). In the reaction used, only short-lived In isotopes and very little In^{114} are formed besides In^{111}. The radiochemical isolation of In according to E. Jacobi requires numerous reprecipitations and is unsuccessful due to the solubility of $Mg(OH)_2$ in ammonium salts. The authors did not succeed in producing In completely free from Fe by applying Gruverman's method of Cd/In^{111} separation. Therefore, they dissolved the irradiated Cd sheet in the smallest possible amount of concentrated HNO_3. Then, they concentrated the solution, added 10 ml of freshly distilled 12% NH_3, and reprecipitated it by adding a 1-ml solution of $In(NO_3)_3$ (1 ml = 1 mg of In). After centrifuging and dissolving $In(OH)_3$ in 2 ml of 10% HNO_3, precipitation with 2 ml of 12% NH_3, dissolution of the deposit in 1 ml of 2N HCOOH, precipitation with NH_3, and dissolution in 0.2 ml of 2N HCOOH, the solution was adjusted to pH = 2 to 3 by means of NH_3. It was separated on a 10-mm^2 carbon electrode(Pt anode) within 4 hr with 0.2 ma/mm^2. (OTS)

20552 LABORATORY STUDY ON THE CHLORINATION REPROCESSING OF NEUTRON-IRRADIATED URANIUM FUELS. D. Naumann. Kernenergie, 5: 118-19 (Feb. 1962). (In German)

The chlorination of neutron-irradiated uranium oxide was investigated as a combined decomposition process. The laboratory method developed is reported. It can be divided into three parts: (1) dissolution by a nonaqueous solution, (2) separation of uranium and plutonium and separation of the fission products on the basis of the different volatilities of the water-free chlorides, and (3) recovery of uranium by nonaqueous methods and isolation of plutonium. A flow diagram of the process is given. (J.S.R.)

20553 PREPARATION OF URANIUM-233. (to United Kingdom Atomic Energy Authority). British Patent 898,192. June 6, 1962.

A method is given for producing U^{233} by neutron irradiation of Th. The method comprises irradiating Th or a Th compound with neutrons of energy ≤1 Mev until the amount of U^{233} is much less than 1% of the unreacted Th^{232}, per-

mitting the irradiated product to age until a large quantity of U^{233} is formed, converting the U and Th into peroxides, and selectively extracting the U^{233} from the Th peroxide. (D.L.C.)

20554 PROCESS FOR SEPARATING IONS BY ION EXCHANGE. Pawel Krumholz. U. S. Patent 3,037,841. June 5, 1962.

A process is outlined for separating rare earths and yttrium from each other by pseudocountercurrent ion exchange. The process comprises nearly saturating (80 to 95% of capacity) a cation exchange resin bed with the rare earth mixture, eluting the resin with a solution of a complexing agent, and collecting separately successive fractions. The resin bed is preferably a sulfonated polystyrene-divinylbenzene copolymer with 4% crosslinkage and has a height of 3 to 4 ft for a −100 + 200 mesh resin or 8 to 12 ft for a −50 + 100 mesh resin. The complexing agent may be ethylenediamine tetraacetic acid or a salt thereof. Several examples of the process are given. (D.L.C.)

ENGINEERING AND EQUIPMENT

General and Miscellaneous

Refer also to abstracts 20315 and 21689.

20555 (AAEC/E-85) AUTOMATIC SOLUTION OF OPTIMUM DESIGN PROBLEMS ON A DIGITAL COMPUTER. B. R. Lawrence (Australia. Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales). Mar. 1962. 10p.

A description is given of a method suitable for the automatic solution of certain optimum design problems on a digital computer for cases where the number of constraints imposed on the design is not greater than the number of design variables. The problem is transformed to one requiring the minimization or maximization of an unconstrained function, for which a gradient method is used. (auth)

20556 (AD-269392) LOW MAINTENANCE MACHINERY FOR SUBMARINE POWER PLANTS. APPENDIX 5. FORCE AND TORQUE VARIATIONS OF THE DOUBLE-ACTING "STEAMOTOR." F. J. Neugebauer (General Electric Co. General Engineering Lab., Schenectady, N. Y.). Sept. 1961. 8p. Contract NONR 3485(00).

Fluctuating forces and moments are caused by mass and gas forces in the 36-cylinder double-acting steamotor due to the arrangement of cylinders and crank shaft. It is shown that a perfect theoretical mass balance can be obtained in the 36-cylinder motor by phasing the cranks as they would be phased in a four-stroke cycle internal combustion engine and arranging the master rods in the direction of the cranks. Schematic arrangements are shown and graphically analyzed. (N.W.R.)

20557 (AD-269396) LIQUID SHEAR TRANSMISSION. Appendix 9. F. J. Neugebauer and B. Sternlicht (General Electric Co. General Engineering Lab., Schenectady, N. Y.). Oct. 1961. Contract NONR-3485(00). 49p.

It appears that a liquid shear transmission can be developed, however, its reliability is questionable in the 15,000 hp range. The minimum film thickness is of the order of 10×10^{-6} inches. Any dirt, thermal or pressure distortions would affect the performance of this transmission. Fluid shear transmissions in the order of hundreds of horsepower are quite feasible and reliable. The weight of this type of transmission is quite low. (auth)

20558 (AD-269397) COMPACT POWER PLANTS. Appendix 10. R. J. Hooker (General Electric Co. General Engineering Lab., Schenectady, N. Y.). Nov. 1961. Contract NONR-3485(00). 22p.

A 15,000 hp power plant was reduced in envelope volume by consolidating and integrating every component. The design incorporates the newer technologies of the steam and water lubricated bearings, improved condenser tube configurations, high-performance boiler feed water pumps, canned generator stator, and rotor components. (auth)

20559 (DC-59-5-41) DESIGN PROPOSAL—A GAS DYNAMIC SYSTEM FOR CONTINUOUSLY HEATING 10 lb/sec OF CLEAN AIR TO 3500°F UNDER PRESSURE. S. E. Eckard (General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati). Apr. 13, 1959. Contract AT(11-1)-171. 48p.

A design is presented for a system to continuously supply 10 lb/sec of 3500° air to a test section. The system may be pressurized to 300 psig or higher. The heat transfer system is a regenerative type which utilizes four ceramic pebble beds as the heat transfer surface. The heat source is combustion products from propane. (auth)

20560 (DC-59-6-253) PRELIMINARY DESIGN—A SYSTEM FOR CONTINUOUSLY HEATING 0.2 lb/sec OF CLEAN AIR TO 3100°F. S. E. Eckard (General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati). June 18, 1959. Contract AT(11-1)-171. 21p.

A preliminary design is presented for a system to continuously heat 0.2 lb/sec of clean air to 3100°F. The minimum life expectancy of the heat source is 100 hr with a possible life exceeding 500 hr. (auth)

20561 (DC-59-9-154) DESIGN CALCULATIONS FOR TWO TEST REMOTELY OPERABLE QUICK DISCONNECTS. J. J. Keim (General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati). Sept. 21, 1959. Contract AT(11-1)-171. 35p.

Design calculations for two flange-type quick disconnects are presented. Both clamps are essentially of the modified Marman type with design changes to accommodate remote handling requirements. These disconnects are for use in connection with propulsion systems components. (J.R.D.)

20562 (DC-60-8-32) PRELIMINARY REPORT OF ADVANCED VIEWING STUDIES FOR REMOTE HANDLING OPERATIONS. J. E. Brown (General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati). Aug. 2, 1960. Contract AT(11-1)-171. 14p.

The problems of proper viewing of remote handling operations are discussed. Presently known methods of remote viewing are surveyed. It is concluded that only small improvements in methods presently employed are possible. It is further concluded that a study of a versatile optical system should be performed to determine feasibility and cost. (auth)

20563 (DC-60-12-129) ALTERNATE FASTENER SURVEY. A. D. Feith (General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati). Dec. 27, 1960. Contract AT(11-1)-171. 14p.

A qualitative discussion of various types of fasteners is presented. Their relative merits as compared to the existing design of captive nuts and bolts are also outlined. (auth)

20564 (DP-666) LEAKAGE OF WATER FROM PUMP MECHANICAL SEALS. David L. Burns (Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.). Nov. 1961. Contract AT(07-2)-1. 11p.

Measurements of water vapor leakage past mechanical seals for pump shafts showed that commercially available mechanical seals do not leak more than about 30 lb/yr of vapor. They are therefore considered to be satisfactory for D_2O pumps, in power reactor applications. Both vapor and liquid leakage were measured in bench-scale tests on mechanical seals from three manufacturers for pump shaft sizes of 2.625- and 3.563-inch diameter, shaft speeds from 500 to 3600 rpm, and pressures from 250 to 1000 psig. At the rated speed of 3600 rpm and the rated pressure of 1000 psig the liquid leakage of the light water used in the tests varied from 0.3 to 17,000 lb/yr. Because the water in the seal chamber of the pump is cooled to about 45°C for these typical mechanical seals, liquid leakage of D_2O would be recoverable and would not represent an economic loss. The liquid leakage from most of the seals showed a general trend to decrease as the shaft speed was decreased and to increase as the pressure was decreased. (auth)

20565 (HW-73119) THE HANFORD RAINDROP SAMPLER AND SELECTED SPECTRA. R. J. Engelmann (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Mar. 21, 1962. Contract AT(45-1)-1350. 24p.

An instrument that utilizes a sensitive paper to record individual raindrop size and particulate content is reported, together with details of its construction and calibration. Means of reducing splash and edge-effect errors are also described. Nine rain and one snow spectra are shown in demonstration of the detail that may be obtained in the small drop portion of the spectrum. (auth)

20566 (IFA/TV/14) METAL-TO-METAL AND CERAMICS-TO-METAL BAKEABLE VACUUM SEALS. George Comsa, Stelian Lungu, and Constantin Simionescu (Academia, R. P. R. Institutul de Fizică Atomică, Bucharest). 1962. 9p.

The design of metal-to-metal and ceramics-to-metal seals is described. Welded Al wire gaskets are used to produce vacuum-tight, bakeable, and demountable seals. (J.R.D.)

20567 (NP-11533) RESEARCH ON THE GENERATION AND ACCELERATION OF SUBMICRON-SIZE PARTICLES. Summary Report Covering, August 1959–February 1962. V. E. Krohn (Space Technology Labs., Inc. Physical Electronics Lab., Canoga Park, Calif.). Feb. 28, 1962. Contract AF33(616)-6775. 58p. (8937-6005-CU-000)

A source for generation of charged liquid droplets of various kinds was studied under a variety of operating conditions. It was found that the conductivity of the working fluid is of prime importance in determining whether charged droplets can be produced without a large number of ions accompanying them, and that the conductivity is also of great importance in determining the charge-to-mass ratio of the droplets. The theoretical limitations on the maximum charge that a droplet of given size can carry were experimentally confirmed. Charged droplets of uniform charge-to-mass ratio and without ions accompanying them were produced with charge-to-mass ratios as high as 470 coulombs/kg. (M.C.G.)

20568 DESIGN OF TRACER LABORATORY. Masayuki Hamada and Shigeru Oue. Ann. Rept. Radiation Center Osaka Prefect., 2: 91-4(1961). (In English)

The design of a tracer laboratory for using unsealed radioisotopes as tracers in experiments not involving living organisms is outlined. The arrangements for disposal of waste water are given. The ventilation system, fume hoods, and tables are described. (D.L.C.)

20569 REDUCTION OF SCATTER RADIATION BY A SIMPLE DEVICE. H. L. Traenkle and V. E. Yoder. A.M.A. Arch. Dermatol., 85: 115(Jan. 1962).

Since glass tips of treatment cones on most therapeutic x-ray machines used in dermatology are made of glass and lack filtering properties, it is suggested that these tips be wrapped in lead rubber or lead foil. By this means, scatter in the treatment room was reduced ~25–75%. (H.H.D.)

20570 MAGNETOHYDRODYNAMIC JOURNAL BEARING. W. F. Hughes and R. A. Elco (Carnegie Inst. of Tech., Pittsburgh). ARS (Am. Rocket Soc.) J., 32: 776-8 (May 1962).

An analysis is presented for a magnetohydrodynamic pressurized journal bearing using a liquid metal lubricant. An external magnetic field is applied axially along the journal, and current is allowed to flow between the journal and bearing. It is found that significant increases in load carrying capacity can be achieved by supplying power from an external source. Open circuit conditions give no additional pressurization, and short circuit conditions result in a pressure decrease. (auth)

20571 IRRADIATION OF SMALL SPHERE GAPS FOR VOLTAGE MEASUREMENT. D. F. Binns (Royal Coll. of Advanced Tech., Salford, Lancs, Eng.) and D. R. Hardy. Commun. and Electronics, No. 60, 155-9(May 1962).

Impulse and direct voltage calibrations are presented for 2 and 6.25-cm-diameter sphere gaps. The calibrations for a 1-mg radium pellet inside the top sphere are compared with those for ultraviolet irradiation. The rate of production of electrons in the gap was measured for both irradiation sources with an electrometer amplifier. Impulse sparkover voltages are consistent when plotted as a function of electron production rate, but there are appreciable differences between $1\frac{1}{2} \times 40$- and 1×50-microsecond wave calibrations. (auth)

20572 TEMPERATURE CONTROL OF IRRADIATIONS IN A Co-60 HOLLOW CYLINDER SOURCE. R. B. Ingalls, F. D. Goodspeed, and J. R. Hardy (Office of Isotope Development, AEC). Intern. J. Appl. Radiation and Isotopes, 13: 93-5(Feb. 1962). (In English)

An apparatus which was used for maintenance of constant temperature during long irradiations in a Co^{60} hollow-cylinder source is described. This apparatus performed reliably for some 20 irradiations at temperatures from −140 to +100°C. The system uses thermostated nitrogen gas which is forced to circulate over the samples during irradiation. The thermostated region is thermally isolated from its surroundings by a silvered Pyrex Dewar which fits into the hollow cylinder source and by polyurethane foam at one end. The advantages of the system are discussed. (M.C.G.)

20573 RESEARCH ON THE COLLISION-RESISTING CONSTRUCTION OF THE SIDES OF A NUCLEAR-POWERED SHIP. REPORT NO. 2. T. Harima, S. Yamagata, and T. Tokuda. Mitsubishi Nippon Jukogyo Giho, 2: 147-60(1961). (In Japanese)

Cross-stiffened structures are effective against collision for the sides of the reactor room of a nuclear-powered ship. Test results on beams, flat plates, and stiffened-plates, subjected to impact loading, are evaluated. Anti-impact characteristics of thicker high-tensile steel plate with those of mild steel plate are compared. (auth)

20574 PACKING OF LIQUIDS FOR IRRADIATION IN NUCLEAR REACTORS. J. F. W. Tertoolen and C. Buijze (Inst. for Analytical Chemistry T.N.O., Rijswijk, Holland). Nature, 194: 1168-9(June 23, 1962).

A simple and cheap method for packing liquids for irradiation in reactors is given which uses table-tennis balls. Two tiny holes are drilled in a ball at a short distance apart, and the ball is filled with liquid by means of a funnel with an injection needle connected to the stem. The holes are closed with a plastic glue, and the ball is packed in closely fitting polythene shells tied together with adhesive tape. The standard is packed in a separate table-tennis ball and irradiated simultaneously with the sample. The balls are very strong and can stand falls of 8 ft, temperatures ~80°C, and dilute mineral acids for a long time without contamination of the sample. (D.L.C.)

20575 DESIGN OF RADIOACTIVE FILTRATION SYSTEMS. S. E. Smith and P. A. S. White (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). Nuclear Eng., 7: 239-44(June 1962).

The different fibrous filters commercially available for

removing radioactive particles from air and coolant gases are described along with the requirements for designing a filtration system. A diagrammatic representation is given of a filtered ventilation system for a typical radiochemical process building. (N.W.R.)

20576 CONSTRUCTION AND OPERATION OF A SODIUM CIRCULATION [SYSTEM]. Otto Lutz and Dietrich Rex (Technische Hochschule, Braunschweig, Ger.). VDI Zeitschrift, 104: 581-7(1962). (In German)

A test plant was built which made it possible to circulate liquid sodium in a closed circuit and to study the behavior of conduction elements which occur in sodium-cooled reactors. The development of the sodium circulation system required special consideration and constructive solutions regarding heat transfer, the sealing of the plant, an oxide-free circulation, fire prevention, electric control, charging with sodium, and startup of the plant. Sodium-fire fighting methods are described. (auth)

20577 PROCESS AND DEVICE FOR REMOTE INDICATION OF THE CO-ORDINATES OF SUSPECTED ELEMENTS IN A NETWORK. Roland Cochinal and Jean Megy (to Commissariat à l'Énergie Atomique). British Patent 898,013. June 6, 1962.

A device for remote position indication of suspected elements in a network being searched for irregularities is designed which is especially applicable to scanning detection of faulty fuel elements in gas-cooled reactors. In this device, a belt bearing the reference numbers of the elements in the network is set in motion when an irregularity is detected and stopped automatically to indicate the reference number of the faulty element in front of the operator. An embodiment of the device is described for a network of 96 ducts arranged in 24 bundles of 4 ducts each. (D.L.C.)

20578 SPECTROGRAPH. Alan Henry Gabriel (to United Kingdom Atomic Energy Authority). British Patent 898,047. June 6, 1962.

A spectrograph for visible and u-v radiation is designed for recording a spectrum as it varies with time, e.g., in explosive reactions, gas discharges, etc. The spectrograph comprises a first slit, a concave mirror in the path of a beam from the slit, a rotating mirror in the path of the beam reflected from the concave mirror, means for dispersing the reflected beam, and recording means. In operation, the focused reflected beam is swept over the aperture of the dispersion means, and the spectrum is also swept over the recording means. An embodiment of the spectrograph is described which gives a time resolution of 10^{-8} sec. (D.L.C.)

20579 IMPROVEMENTS IN OR RELATING TO DEVICES FOR PRODUCING DISCONTINUOUS ROTARY MOVEMENT. (to Commissariat a l'Energie Atomique). British Patent 898,259. June 6, 1962.

A device of the piston, helicoidal groove, and pin type is designed for transforming alternating rectilinear movements into discontinuous rotary movements. The device comprises a cylinder, a piston movable in the cylinder, an intermediate sleeve between the cylinder and piston, and means for connecting the sleeve to and for disconnecting it from the cylinder, the groove/pin system being carried by the piston/sleeve system. In the operation of the device, the sleeve is connected to the cylinder during the outward movement of the piston and disconnected therefrom during the return movement of the piston, thus producing an on-off rotation in one direction of the splined shaft attached to the piston. (D.L.C.)

20580 APPARATUS FOR TREATING INERT GAS. Thomas Walbank. British Patent 898,628. June 14, 1962.

An electron tube is designed for rendering inert gas or nitrogen capable of chemical combination. The tube contains a plurality of electron-emitting discharge coils, a series of staggered baffle plates, and means for passing the gas through the tube. The nitrogen produced in this way may be used to harden steel plates for use as radiation shielding which does not absorb neutrons. (D.L.C.)

20581 IMPROVEMENTS IN THE PRECIPITATION OF ELECTRICALLY CHARGED PARTICLES FROM GASES. Frank Harlen (to Dowty Electrics Ltd.). British Patent 898,644. June 14, 1962.

A precipitation chamber is designed in which the precipitation of charged particles may be concentrated onto a small portion of the wire within the chamber. The chamber includes one or more electrodes positioned to direct charged particles onto a small portion of the wire length. The chamber is of special application to precipitation and radiation detection apparatus in which the detector operates on only a small portion of the wire. (D.L.C.)

20582 MANIPULATING APPARATUS. Léon Le Flem, Enghien les Bains, and Jacques Jouin (to Commissariat a l'Energie Atomique). U. S. Patent 3,036,966. May 29, 1962.

An apparatus is designed to be placed opposite an irradiation channel in a reactor in order to carry out the operations of loading, unloading, and transferring the capsules by remote control. The apparatus comprises a protection block having a longitudinal channel provided with a slider, means for securing a graphite brick with cavities on this slider, an unloading pipe, a loading pipe, a transfer box with cavities aligned similarly to those of the graphite brick, and remote control means for removing capsules from the cavities of the brick. (D.L.C.)

20583 CASE FOR NUCLEAR LIGHT SOURCE MATERIAL. George G. Bartolomei (to Associated Nucleonics, Inc.). U. S. Patent 3,037,067. May 29, 1962.

An improved case for use with a light source device or a nuclear battery is designed which may be constructed easily and loaded automatically. The case comprises a shallow internal chamber with an opening leading to an internal channel of greater depth than the chamber and has external recesses for attaching photoelectric cells. The chamber is filled with a phosphor mixed with a radioactive material. (D.L.C.)

20584 FILM DEVELOPING ENVELOPE. David R. Telson. U. S. Patent 3,037,117. May 29, 1962.

An envelope is designed for encasing x-ray film for exposure and development in daylight with open developing tanks. The envelope is made of a water-permeable material transparent to the x rays but opaque to visible light, e.g., black filter paper. A barrier in the form of a meshwork of fiber elements is provided to separate the film from the envelope and to permit free passage of water, developer, and fixer. (D.L.C.)

20585 EQUIPMENT FOR HANDLING DANGEROUS SUBSTANCES. Kenneth Winfield Bagnall and Daniel Stewart Robertson (to United Kingdom Atomic Energy Authority). U. S. Patent 3,038,787. June 12, 1962.

A gas-tight chamber is designed for carrying out operations or treatments on radioactive or toxic materials. The chamber has a window with glove ports, and a turntable is located within the chamber. Ports are provided for rotating the table, and a horizontal passageway beneath the chamber may be used to transfer materials or equipment to another chamber. (D.L.C.)

20586 METHOD AND APPARATUS FOR LOADING AND HANDLING A RADIOACTIVE SOURCE. Robert A.

Loos and Simon H. Johnson (to Curtiss-Wright Corp.). U. S. Patent 3,038,999. June 12, 1962.

An irradiation facility for irradiating grain is described which uses a source of a plurality of Co^{60} slugs. The source comprises a metal cylinder containing two concentric circular rows of tubes which are filled with slugs of Co^{60} or compacted radioactive material. A cask with a plug for the storage of the source is described. A shipping container and loading device is designed for loading the slugs into the source. (D.L.C.)

20587 FLEXIBLE PROTECTIVE PLASTIC SHIELD. Edwin A. Park and Charles B. Kamiss (to Neolon Corp.). U. S. Patent 3,039,001. June 12, 1962.

A process is given for preparing a vinyl film or sheet of material which is impervious to x rays, gamma rays, neutrons, and secondary cosmic rays and which is flexible enough for use as wearing apparel. The sheet includes resin, plasticizer, stabilizer, and pulverized lead, and a pigment may be incorporated therein or on the sides. (D.L.C.)

20588 HIGH TEMPERATURE PRODUCTION. Heinz Fischer. U. S. Patent 3,039,018. June 12, 1962.

A high temperature generating apparatus is designed which is based on the bridging of a gap formed by spaced electrodes with an electric current from the breakdown discharge of a capacitor assembly. The apparatus is similar to that described in U. S. Patent 3,039,018, except for modifications which increase the ratio of the rate of energy input to the gap to the rate of energy dissipation. (D.L.C.)

Heat Transfer and Fluid Flow

Refer also to abstract 20313.

20589 (AFCRL-942) THE INFRARED HEAT TRANSFER GAUGE. Research Note 265. M. Camac and R. Feinberg (Avco-Corp. Avco-Everett Research Lab., Everett, Mass.). Oct. 1961. Contracts AF 19(604)-7458 and AF 49(638)-61. 92p. (AFOSR-1564)

A heat transfer gage that operates in the presence of highly ionized plasmas and in strong electric and magnetic fields was developed. The principle of its operation is to use a thin opaque surface as the heat transfer element. Aerodynamic and radiative heating is applied to one side of this layer while measurements are made of the change of the infrared emission from the other side. Since the layer is initially at room temperature, the predominant radiation from the surface is in the infrared band from 5 to 30 microns. The opaque layer is made thin enough so that the temperature of the front surface can be determined in less than 0.1 microsecond. The components of the heat transfer system and the methods for calibrating the gage are described. Measurements are presented of radiative and aerodynamic heat transfer from air with the use of this heat transfer gage. The infrared heat transfer system worked successfully in the presence of strong electromagnetic fields; side wall heat transfer measurements were made on the MAST where the temperature of the hydrogen plasma was in excess of 100,000°K. (auth)

20590 (ASD-TDR-62-88) INVESTIGATION OF MATERIALS FOR VACUUM INSULATION UP TO 4000°F. Period Covered January 15, 1960 through July 14, 1961. Peter E. Glaser, Alfred E. Wechsler, Ivan Simon, and Joan Berkowitz (Little (Arthur D.) Inc., Cambridge, Mass.). July 1961. Contract AF 33(616)-6816. 88p.

An investigation was made of materials for vacuum insulation up to 4000°F. ADL-17, graphite fibers, thoria powder, and tantalum radiation shields were chosen as insulation components for long-term high-temperature tests on the basis of theoretical studies of both the mechanisms of heat transfer through evacuated insulation materials and preliminary experimental work. Thermal protection systems consisting of these materials were chemically and physically stable enough to be effective insulators for over 100 hr at temperatures of 3000°F and for several hours at 3500°F. Although only readily available materials were utilized, their insulating performance points to the potential effectiveness of improved materials. (auth)

20591 (ATL-A-113) EXPERIMENTAL INVESTIGATION OF THE EFFECTS OF ULTRASONIC VIBRATIONS ON BURNOUT HEAT FLUX WITH BOILING WATER. Quarterly Technical Progress Report, October–December 1960. Fred E. Romie (Advanced Technology Labs. Div. of American Standard, Mountain View, Calif.). Work performed under United States–Eur[illegible]tom Joint Research and Development Program. Contract [illegible]04-3)-250. 4p. (EURAEC-104)

The effects of an ultrasonic field on the maximum nucleate heat flux that can be sustained by boiling water in a flow system are being investigated. Design and procurement of apparatus is underway. (M.C.G.)

20592 (EURAEC-264) STATISTICAL METHODS FOR HOT CHANNEL AND HOT SPOT CALCULATION. Quarterly Progress Report No. 4, October 1, 1961 to December 31, 1961. (FIAT. Sezione Energia Nucleare, Turin). Jan. 31, 1962. Work performed under United States–Euratom Joint Research and Development Program. Contract 035-60-11RDI. 32p. (FN-E-16)

An IBM-7090 code, SHOC, was developed for computing the probability and distribution functions of the most important thermal and hydraulic variables in a boiling reactor. The code is based on a spot model which utilizes a sampling technique of the Monte Carlo type. A study of aleatory function theory is described, and a statistical calculation was made of the probability densities of a one-velocity bare reactor. The spot model was applied to the evaluation of an equivalent friction factor for pressure-drop calculations. (D.L.C.)

20593 (TID-15637) BASIC EXPERIMENTAL STUDIES ON BOILING FLUID FLOW AND HEAT TRANSFER AT ELEVATED PRESSURES. Monthly Progress Report, April 1962. Bruce Matzner (Columbia Univ., New York. Engineering Research Labs.). Apr. 30, 1962. Contract AT(30-3)-187. 14p. (MPR-XIII-4-62)

Successful operation of the High Heat Flux 19-Rod Test Section was achieved. The areas of safe operation for this geometry were greatly extended over those demonstrated with the first 19-Rod Test Section. Thirty data points were recorded for 5 mass velocities between 0.5 and 2.0×10^6 lb/hr-ft^2, at outer rod heat fluxes as high as 996,000 Btu/hr-ft^2 with exit qualities as high as 35%. About one-third of these points are regarded as reliable instrumented burnout data. Test operations were concluded by an intentional physical burnout which occurred quite close to the instrumented burnout point. A program for future 19-rod test sections is proposed which will assure reasonably complete coverage of all required burnout data. Fabrication of the Solid Tubular Test Section is nearing completion. Fabrication was started on the spool pieces needed to permit the test section housing to handle heater tubes with a heated length of 6 ft. (auth)

20594 (USNRDL-TR-436) WATER TRANSPORT OF PARTICULATE MATTER ON AN IDEAL SURFACE AT 0.00

SLOPE. R. H. Heiskell and R. J. Crew (Naval Radiological Defense Lab., San Francisco). July 7, 1960. 30p.

This is the fourth in a series of tests to determine the optimum and limiting considerations for the transport of particulate matter by water films. It was found that conventional laminar-flow theory does not hold for thin water films at a slope of 0.08. The individual particle transport rate at this slope can be computed from the empirical equation $U = 0.000520D(\sqrt{Q}-0.069) + 0.01$ for the spherical particles and the velocity of irregularly shaped silica particles can be expressed as $U = 0.001278D(\sqrt{Q}-0.480) + 0.05$ where U = particle velocity in ft/sec, Q = water flow rate in gpm/ft of width, and D = diameter of particles to be transported in microns. The 137-micron size irregular particles gave the lowest mass loading rate for all the water flow rates studied at this slope. The maximum quantity of this size irregular particle which could be transported ranged from 150 to 2450 g/ft^2/min for flow rates of 0.37 to 2.70 gpm/ft of width. The maximum loading rate for the 68-micron diameter spheres was 50 to 1600 g/ft^2/min for flow rates of 0.37 to 1.83 gpm/ft of width. (auth)

20595 (XDC-60-1-158) AN ANALYTICAL STUDY OF A BALANCED REVERSE FOLDED FLOW. J. F. Heyda (General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati). Jan. 15, 1960. Contract AT(11-1)-171. 19p.

An incompressible, inviscid fluid under high pressure flows at a small angle of inclination to a porous resistance. Upon flowing through the resistance, it emerges at right angles to it, turns abruptly and leaves in a direction opposite to that of the inlet flow. Thus, in a short space the flow is "folded over" twice, achieving a reversal in its original direction. A mathematical model of the flow is assumed and an analytical solution is obtained for the variation in static pressure for both inlet and outlet regions when the pressure drop across the resistance is constant, i.e., when the flow is "balanced." When the wall in the outlet region is straight, that in the inlet region is approximately straight and the resulting trapezoidal flow region, for an assumed total system pressure drop, is minimized, the sides of the trapezoid being simply interrelated. Equations are presented for determining the sensitivity of the mass flow rates to small changes in the geometry of the flow region. Finally, consideration is given to the general case involving a non-linear wall in the outlet region and an approximate inversion formula for the static pressure gradient is derived. (auth)

20596 (EURAEC-33) IMPROVEMENT OF HEAT TRANSFER IN BOILING WATER REACTORS. Quarterly Report No. 1 (April–June 1960). (Société Nationale d'Etude et de Construction de Moteurs d'Aviation. Division Atomiques, Suresnes, France). Aug. 24, 1960. Work Performed under United States–Euratom Joint Research and Development Program. Contract [017-60-4RDF]. 15p A Translation.

Studies are being made on two-phase discharges with single vortex. A system using colored, conducting puffs was developed for determining the speed of the liquid at the inlet and outlet tubes. Thermal tests were made with and without spiral strips in the circulation loop. A study of a water-steam separation loop was completed and its manufacture begun. (M.C.G.)

20597 (EURAEC-144) STUDY OF TWO-PHASE FLOWS (AIR–WATER) WITH VORTEX CYLINDRICAL AND ANNULAR FLOWS. Special Report No. 3. C. Foure, A. Beghin, B. Bernard, and A. Mihail (Société Nationale d'Étude et de Construction de Moteurs d'Aviation. Division Atomiques, Suresnes, France). June 12, 1961. Work performed under United States–Euratom Joint Research and Development Program. Contract [017-60-4RDF]. 82p. A Translation.

The results of measurements of two-phase water-air, fall of pressure and vacuum fractions, both in conventional cases and with types of flow likely to produce an effect on the heat transfer characteristics at boiling point, are presented. The experimental equipment used during the tests is described. The falls in pressure in cylindrical annular flow, with and without twisted tape, were compared. Tests carried out with two-phase flow enabled the gradients in the falls in pressure and vacuum fraction to be studied with and without twisted tape. The influence of the water flow speed, the shape of the flow, the hydraulic diameter, and the thread of the twisted shape in the case of single and bracketed vortices was also demonstrated. The vortices induced by jets were also investigated. (M.C.G.)

20598 (EURAEC-146) INFLUENCE ON BURN-OUT FLUX OF VORTICES INDUCED IN BOILING WATER AT ATMOSPHERIC PRESSURE. Special Report No. 5. C. Foure, A. Rosuel, and G. Sourioux (Société Nationale d'Étude et de Construction de Moteurs d'Aviation. Division Atomiques, Suresnes, France). [1961]. Work performed under United States–Euratom Joint Research and Development Program. Contract [017-60-4-RDF]. 146p. A translation.

Improvement of the heat transfer coefficient by creating vortices in a flow was studied for the case of water at atmospheric pressure and at low flow velocities. The zone explored was between 1000 and 2800 kw/m^2. For the tubular test section, intake velocities were less than 1 m/sec. It was found that there exists a reduced half-pitch limit above which the addition of twisted tape is not favorable. Below this pitch, the same pumping power led to a gain in flux. In the annular test section the gain in flux was considerable. Contrary to the case of the tubular section, the twisted tape y = 9 improved the heat transfer also. At equal pumping power, for y = 3, the increase in burnout flux was 53%. (M.C.G.)

20599 (FTD-TT-62-298) THE STEADY-STATE FLOW OF A CONDUCTING FLUID ALONG A RECTANGULAR TUBE, IN AN EXTERNAL MAGNETIC FIELD, WITH TWO CONDUCTING AND TWO NONCONDUCTING WALLS. G. A. Grinberg. Translated from Doklady Akad. Nauk S.S.S.R., 141: 330-3(1961). 6p.

Equations for steady-state motion of a conducting, viscous, incompressible fluid through a tube in an external magnetic field were solved. A solution was obtained for the problem of a rectangular tube whose walls perpendicular to the external magnetic field are ideally conducting, while the walls parallel to the field are nonconducting. (M.C.G.)

20600 TEMPERATURE AND HEAT CURRENT DISTRIBUTION IN TUBULAR FUEL ELEMENTS IN REVERSED AND DIRECT COOLANT FLOW. Shigebumi Aoki (Tokyo Inst. of Tech. and Technische Hochschule, Hanover). Atomkernenergie, 7: 52-7(Feb. 1962). (In German)

If hollow cylindrical fuel elements are used in power reactor, especially for nuclear superheater, the maximum temperature becomes lower than in rod-like elements. The temperature change in coolant, temperature distribution in a hollow cylindrical fuel element, and the distribution of heat flow into the inner and the outer channel for two cases of coolant flow, namely reversed flow and parallel flow, are given. (auth)

20601 THE RELATION BETWEEN BUBBLE FREQUENCY AND DIAMETER DURING NUCLEATE POOL

BOILING. P. W. McFadden and P. Grassmann (Swiss Federal Inst. of Tech., Zurich). Intern. J. Heat and Mass Transfer, 5: 169-73(Mar.-Apr. 1962). (In English)

Data concerning the frequency and diameter with which bubbles leave a given bubble site in nucleate pool boiling are presented. The data were obtained from a boiling study of liquid nitrogen. It is shown that the existing correlation relating the frequency and diameter does not predict the data. From a dimensional analysis coupled with available experimental data a new relationship was developed, viz.f. $D^{\frac{1}{2}}$ = const. A simple force balance on the departing bubble is shown to indicate the same result. (auth)

20602 A VARIATIONAL METHOD FOR COMBINED FREE AND FORCED CONVECTION IN CHANNELS. H. C. Agrawal (Indian Inst. of Tech., Kharagpur). Intern. J Heat and Mass Transfer, 5: 439-44(June 1962). (In English)

A variational method is presented for application to problems of combined free and forced convection in vertical channels. The method is applied to flow in a vertical rectangular channel and the results are compared with exact solutions. The method is extended for circular ducts. (auth)

20603 INFLUENCE OF ELECTRIC FIELD ON THE COOLING GAS FLOW IN A NUCLEAR REACTOR. V. Stach (Nuclear Research Inst., Czechoslovak Academy of Sciences, Prague). Intern. J. Heat and Mass Transfer, 5: 445-56(June 1962). (In English)

Slightly ionized gas flow that corresponds to the flow of a reactor cooling gas ionized by nuclear radiation is considered. The gas properties are known from experiments carried out in a reactor loop. It is shown that a transverse electric field may influence the gas flow. This influence is quite analogous to that of a gravitational field upon the liquid flow with non-uniformly distributed density in so-called stratified flows. (auth)

20604 AN ANALYTICAL AND EXPERIMENTAL STUDY OF TURBULENT GAS FLOW BETWEEN TWO SMOOTH PARALLEL WALLS WITH UNEQUAL HEAT FLUXES. H. Barrow (Univ. of Liverpool). Intern. J. Heat and Mass Transfer, 5: 469-87(June 1962) (In English)

A theoretical and experimental study is reported of asymmetric heat transfer to air in fully developed turbulent flow between two smooth parallel plates. The heat fluxes at the plate surfaces are of different magnitude; in the theoretical analysis, each surface heat flux is assumed to be uniform in the flow direction. In the experimental work, two-dimensional flow is simulated by means of long ducts of large aspect ratio. Velocity distribution and friction data in adiabatic flow are recorded, and show agreement with predictions. Heat-transfer measurements are made with one wall insulated, and then with heat transfer at both walls. In the latter series of experiments, the wall fluxes are unequal and of opposite sign. The experimental heat-transfer coefficient for the wall through which heat is transferred to the fluid is observed to be less than the predicted value for the case of symmetrical heat transfer and to decrease as the degree of asymmetry increases. A decrease in heat transfer coefficient of up to about 40 per cent is measured. The theory, which is based on the analogy between the transfers of heat and momentum, is rigorous and is supported by the experimental data. It is concluded that the heat-transfer coefficient is dependent on the heat-flux distribution around the circumference of the flow section. (auth)

20605 A HYDRODYNAMIC MODEL FOR NUCLEATE POOL BOILING. C. L. Tien (Univ. of California, Berkeley). Intern. J. Heat and Mass Transfer, 5: 533-40(June 1962). (In English)

A hydrodynamic model of stagnation flow is proposed for saturated nucleate boiling over a flat surface. Using analytical results from axisymmetrical stagnation flow, a relation between the heat-transfer coefficient and the thermal boundary-layer thickness induced by rising bubbles is obtained, and agreement with measured results in the low heat-flux region is indicated. The predicted heat-transfer result is given, and found to be in agreement with boiling data of most liquids. (auth)

20606 INVESTIGATION ON RESISTANCE AND HEAT TRANSFER OF TURBULENT AIR FLOW IN AXISYMMETRICAL CHANNELS WITH LONGITUDINAL PRESSURE GRADIENT. P. N. Romanenko, A. I. Leont'ev and A. N. Oblivin (Moscow State Timber Inst.). Intern. J. Heat and Mass Transfer, 5: 541-57(June 1962). (In English)

Experimental investigations on the properties of a turbulent boundary layer are reported, for a flow of heated air in axisymmetrical diffuser and confuser channels having cooled walls. The experimental set-up makes possible a determination of the influence of longitudinal pressure gradients and cooling intensity upon the properties of dynamic and heat boundary layers. The treatment and generalization of the experimental data are carried out in a parametric form. Dependences of form parameters, characterizing the form of the velocity and temperature profile, but also determining the law of friction and heat transfer from the longitudinal pressure gradient, are found. These dependences on the longitudinal pressure gradient are found, and given in the form of design equations. The experimental material obtained makes possible development of methods of calculation of a turbulent layer for gas flow with both longitudinal pressure gradient and heat transfer, which makes possible determinations of thicknesses of momentum and energy loss, thicknesses of dynamic and heat displacement, and the tangential stress and specific heat flow on a wall. Moreover, the results are presented of an experimental investigation on the distribution of the tangential stress and specific heat flow, as well as that of turbulent transfer coefficients of momentum and heat, by a section of the turbulent boundary layer at the gradient flow. (auth)

20607 HYDROMAGNETIC HEAT TRANSFER. G. H. A Cole (Clarke, Chapman and Co., Ltd., Durham, Eng.). Nature, 194: 564-5(May 12, 1962).

A dimensional analysis is performed for forced convective heat transfer between a flowing electrically conducting viscous fluid and a boundary surface in a steady magnetic field. Equations are derived which may be used in conjunction with heat transfer measurements to determine the electric conductivity for one fluid in terms of a standard fluid. The cases of natural convection and rotating fluid are considered. (D.L.C.)

20608 INTERACTION OF SHOCK OR RAREFACTION WITH A BUBBLE. Martha W. Evans, Francis H. Harlow, and Billy D. Meixner (Los Alamos Scientific Lab., N. Mex.). Phys. Fluids, 5: 651-6(June 1962).

Interactions of a shock or rarefaction wave with a bubble were studied theoretically, using a numerical method for solving the equations of compressible flow. Configurations and isotherms are presented for times up to late stages of the interactions, and results are compared with experiments. (auth)

20609 ASYMPTOTIC SOLUTIONS FOR SINK FLOW IN A STRONG MAGNETIC FIELD. L. S. G. Kovasznay and F. C. W. Fung (Johns Hopkins Univ., Baltimore). Phys. Fluids, 5: 661-4(June 1962).

For fluid with finite electric conductivity placed in a

magnetic field, the dissipative term of magnetic origin causes the governing equation to be nonsymmetric with respect to source and sink. Sink flow of an incompressible, nonconductive, perfect fluid is spherically symmetric with the velocity falling off according to an inverse square law. If the fluid is endowed with finite electrical conductivity, and a strong parallel uniform magnetic field is imposed, the magnetic lines will channel the flow along the preferred direction. Far away from the sink, a similarity solution exists. Both the velocity field and the magnetic perturbation field were computed, and they represent an axisymmetrical wake-type configuration. The velocity on the axis falls off as $z^{-\frac{1}{2}}$, and the width of the wake increases as $z^{\frac{1}{4}}$. The axial disturbance of the magnetic field is maximum on the z axis and drops off as z^{-1}. The radial component vanishes on the axis, and, for a given relative position, falls off as $z^{-\frac{1}{2}}$. (auth)

20610 THE CALCULATION OF HEAT FLOW IN MELTING SOLIDS. Mark Lotkin (AVCO Research and Development, Wilmington, Mass.). Quart. Appl. Math., 18: 79-85(Apr. 1960).

The numerical integration of heat conduction equations was extended to include the phenomenon of melting. The physical situation is defined, and the governing mathematical equations are stated. These differential equations are replaced by analogous difference equations, and the resulting truncation terms are noted. The results obtained with an IBM-704 program using these equations were satisfactory. (M.C.G.)

20611 ON THE FLOW OF A VISCOUS ELECTRICALLY CONDUCTING FLUID. H. P. Greenspan (Massachusetts Inst. of Tech., Cambridge). Quart. Appl. Math., 18: 408-11(Jan. 1961).

The equations governing the steady two-dimensional flow of a conducting fluid whose free stream direction is parallel to an applied magnetic field can be linearized by an extension of the Oseen treatment of viscous flows and reduced to the dimensionless form. The equations will then admit general solutions making an entire class of parabolic flow problems explicitly soluble in terms of known elementary functions. As examples, flow past a semi-infinite flat plate and flow past a parabolic cylinder were considered. (M.C.G.)

20612 ON OPTIMUM RECTANGULAR COOLING FINS. Chen-ya Liu (Carnegie Inst. of Tech., Pittsburgh). Quart. Appl. Math., 19: 72-5(Apr. 1961).

A parametric solution for a rectangular cooling fin of a heat exchanger is given in terms of known functions, from which the optimum geometry of the fin with the least weight is determined. (M.C.G.)

20613 PROCEEDINGS OF THE 1962 HEAT TRANSFER AND FLUID MECHANICS INSTITUTE, HELD AT UNIVERSITY OF WASHINGTON, JUNE 13, 14, 15, 1962. Preprints of Papers. J. Edward Ehlers, James J. Kauzlarich, Charles A. Sleicher, Jr., and Robert E. Street, eds. Stanford, California, Stanford University Press, 1962. 300p. $8.50.

Nineteen papers are included; separate abstracts have been prepared for seven. Information presented concerns current and fundamental research in fluid flow, heat transfer, and related fields. (N.W.R.)

20614 DETAILED FLOW FIELD IN TRANSITION. L. S. G. Kovasznay, H. Komoda, and B. R. Vasudeva (Johns Hopkins Univ., Baltimore). p.1-26 of "Proceedings of the 1962 Heat Transfer and Fluid Mechanics Institute." Stanford, California, Stanford University Press, 1962.

The breakdown of the laminar boundary layer on a flat plate with zero pressure gradient was studied by using a 10-channel linearized, d-c coupled hot-wire system. The detailed instantaneous flow field was mapped out in the breakdown phase of a three-dimensionally excited laminar instability wave. The development of the flow field was followed from the conventional Tollmien-Schlichting waves into the one and two spike stage in a detailed and quantitative manner. (auth)

20615 TWO PHASE FLOW THROUGH AN APERTURE. H. S. Isbin and G. R. Gavalas (Univ. of Minnesota, Minneapolis). p.126-40 of "Proceedings of the 1962 Heat Transfer and Fluid Mechanics Institute." Stanford, California, Stanford University Press, 1962.

The design of nuclear reactor containment systems is based upon the energy release rates postulated for given classes of reactor accidents. One condition involves the outflow of water from a break in the reactor vessel containing saturated water. Analytical solutions are available for the flow of one-phase, incompressible and compressible ideal fluids through a two-dimensional aperture, and approximate solutions were developed for the three-dimensional openings. Some related experimental investigations of the flow of two-phase mixtures and the flow of saturated water through openings are available, but the results are not sufficient to develop the necessary criteria and working models for the more general problem. Thus, the results of calculations made for models approximating the flow of steam-water mixtures through apertures are presented. Conditions for the evaluations range from the flow described as a single phase, steady, plane, irrotational, and incompressible flow to a homogeneous non-equilibrium, plane, steady, and irrotational mixture flow. (auth)

20616 TURBULENT LIQUID JET INTRUDING INTO A BOILING STREAM. S. G. Bankoff (Northwestern Univ., Evanston, Ill.). p.155-70 of "Proceedings of the 1962 Heat Transfer and Fluid Mechanics Institute." Stanford, California, Stanford University Press, 1962.

Reichardt's inductive theory is used to calculate the mixing of a cold turbulent liquid jet with a boiling liquid stream. This problem assumes importance, for example, in the downcomer of a natural circulation nuclear reaction. It is assumed that the characteristic times for bubble collapse are small compared to those for enthalpy transport, and also that the bubbles are small and uniformly distributed. This allows the replacement of the bubbly free-stream fluid by a hypothetical single-phase fluid of equivalent density and enthalpy. Because of the linearity of the formulation, superposition principles may be applied to extend the calculations to any number of jets. (auth)

20617 NUCLEATION AND BOILING FROM A LIQUID-LIQUID INTERFACE. R. Viskanta and P. A. Lottes (Argonne National Lab., Ill.). p.171-84 of "Proceedings of the 1962 Heat Transfer and Fluid Mechanics Institute." Stanford, California, Stanford University Press, 1962.

An experimental investigation of nucleate boiling of saturated water and n-hexane from a mercury surface at atmospheric pressure was made. Visual observations revealed that there existed favored locations for bubble formation on the mercury surface, and it was also noted that a nucleation site sometimes became displaced because of agitation and flow currents, even without an intermission in the activity of a site. The superheats required to initiate boiling from a liquid surface were higher than those for boiling from a solid surface. However, boiling usually started at lower superheats than those reported for static-type measurements because the presence of contaminants and gases absorbed and adsorbed on the mercury surface. The results also showed that the position and slope of the

nucleate boiling curve varied with the immediate history of boiling from the liquid-liquid interface. (auth)

20618 A PHOTOGRAPHIC STUDY OF BUBBLE DIMENSIONS AND BOILING ACTION ON MERCURY AND STANDARD ENGINEERING SURFACES. Bernard Otterman (New York Univ., New York). p.185-96 of "Proceedings of the 1962 Heat Transfer and Fluid Mechanics Institute." Stanford, California, Stanford University Press, 1962.

Nucleate boiling of water and isopropanol at low and intermediate values of heat flux density from metal surfaces was investigated. Bubble diameters and contact angles at breakoff were measured. It was concluded that the Fritz equation can be used only to correlate bubble diameters at low values of heat flux density. At intermediate values of heat flux density most individual bubbles coalesced while still attached to their respective nucleating centers, or immediately after detaching from the heater surface. It was concluded that a correlation for non-coalesced bubble diameters must include the effects of bubble drag at departure. Experiments were also conducted for water and isopropanol on clean and dirty mercury surfaces. At superheats attained, nucleation characterized by the repetitive formation and release of bubbles from a specific spot on the heater surface did not occur on clean mercury surfaces. Liquids heated on a dirty mercury surface exhibited nucleate boiling at superheat typical of commercial surfaces. (auth)

20619 INTERACTION OF A PLASMA JET WITH A MAGNETIC FIELD. F. D. Hains and F. Edward Ehlers (Boeing Scientific Research Labs., [Seattle]). p.206-22 of "Proceedings of the 1962 Heat Transfer and Fluid Mechanics Institute." Stanford, California, Stanford University Press, 1962.

The interaction of a plane plasma jet and the magnetic field produced by a straight wire is studied theoretically. The equations of continuum flow are used in this analysis along with the assumptions that the gas is non-viscous and non-heat conducting. For plasmas with low conductivity, the magnetic Reynolds number is small; and it is possible to uncouple Maxwell's equations from the equations of motion. With a strong magnetic field, the interaction parameter N and the magnetic body force are of first order. For a given supersonic Mach number at the jet exit, the jet shape and pressure distribution were found and the resultant force on the wire was obtained by integration of the equal and opposite Lorentz forces over the entire jet. Results up to 0.1 indicate a linear variation of the resultant force with N with no variation in direction. If the interaction parameter is small, it is possible to linearize the governing equations and treat jets with subsonic as well as supersonic exit conditions. Solutions were found in a closed form approximation for subsonic flow and convergent functions for supersonic flow. The condition of constant pressure along the jet free surface was satisfied on the undisturbed jet boundary. The velocity distributions were computed for Mach numbers of 0.5 and 1.2 and for the wire located at one-half and at 0.2 of a jet width away from the undisturbed free boundary. The flow was found to be decelerated along boundary streamlines in subsonic and supersonic flows. The jet widens until it reaches a neighborhood of the wire where it is sharply constricted and then continues to widen downstream of the wire. For N = 0.02, the calculations from the linearized theory compare favorably with the results obtained by the non-linear method of characteristics. (auth)

20620 SLIP FLOW IN THE ENTRANCE REGION OF A PARALLEL PLATE CHANNEL. E. M. Sparrow, T. S. Lundgren, and S. H. Lin. p.223-38 of "Proceedings of the 1962 Heat Transfer and Fluid Mechanics Institute." Stanford, California, Stanford University Press, 1962.

Flow in the hydrodynamic entrance length of a parallel-plate channel under the condition that the gas density is low enough to permit a velocity slip at the wall is analyzed. The fully-developed characteristics of the slip flow are also derived. The problem is attacked by two independent but complementary methods of analysis, the results of which are in satisfactory agreement. The results show that for given flow conditions, the effect of slip is to decrease the pressure drop and to increase the entrance length. The axial variation of the developing velocity profiles is shown in detail. (auth)

20621 IMPROVEMENTS IN OR RELATING TO VALVED DUCTING. George Blackburn and Everett Long (to United Kingdom Atomic Energy Authority). British Patent 897,444. May 30, 1962.

A coaxial valved ducting is designed for fluid flow to and from a heat exchanger. The ducting comprises an inner pipe for flow of hot fluid, an outer pipe providing an annular passage for the countercurrent flow of cool fluid, a butterfly valve in the inner pipe, peripherally spaced longitudinal ribs joining the two pipes in the region of the valve, an extension of the outer pipe, and a butterfly or poppet valve associated with the extension. The inner pipe communicates with the heat exchanger by means of an extension through the outer pipe wall. (D.L.C.)

20622 IMPROVEMENTS IN OR RELATING TO HEAT EXCHANGE APPARATUS. (to Durrwerke A. G.). British Patent 897,866. May 30, 1962.

A once-through forced-flow vapor generator for a nuclear power plant is designed with means for regulating the temperatures at which heat carrier fluid and working fluid leave the generator. The generator comprises a chamber for the flow of heat carrier fluid, a tube system for the flow of working fluid, a by-pass for working fluid, means for varying the proportion of working fluid flowing through the by-pass, and means for varying the flow rate of working fluid through the tube system. The operation of the vapor generator in a nuclear power plant is described. (D.L.C.)

20623 FLUID FLOW CONTROL VALVE. Robert Munro (to United Kingdom Atomic Energy Authority). British Patent 898,352. June 6, 1962.

A reliable fluid flow control valve is designed which can hold a high vacuum for prolonged periods of time and needs to be made only to ordinary engineering tolerances. The valve comprises a metal body chamber, a closure member fitting loosely in the chamber with thin elastic walls adjacent the chamber walls, and means for expanding the thin walls against the chamber walls by fluid pressure. (D.L.C.)

20624 IMPROVEMENTS IN OR RELATING TO ELECTROMAGNETIC FLOWMETERS. Percy Eric Thorpe (to United Kingdom Atomic Energy Authority). British Patent 899,095. June 20, 1962.

An electromagnetic flowmeter is designed for operation under high temperature and pressure conditions. The flowmeter comprises a body member defining a bore and an electrically insulating sleeve loosely lining part of the bore. The sleeve is designed so that fluid may penetrate between the sleeve and body to balance the pressure across the sleeve. Two diametrically opposed electrodes are arranged to contact the fluid to measure the induced emf. (D.L.C.)

Instrumentation

Refer also to abstracts 21434, 21435, 21436, 21437, 21438, 21439, 21440, 21441, 21442, 21443, and 2166

20625 (AD-265927) 200-MILLIROENTGEN RADIACMETER RESEARCH. Final Report, February 15, 1960 to September 1, 1960. C. R. Siebentritt, Jr., R. A. Sardeson, B. M. Watson, T. J. Carraher, J. P. Frank, H. T. Anderle, E. Vore, G. Egan, R. Koehl, R. Sandwina, J. Byer, and R. Reckner (Bendix Corp., Cincinnati). July 31, 1960. Contract NObsr-72754(1734F). 146p. (R-60-CDE-01-03)

Detailed instructions are given for manufacturing, processing, and testing the Bendix-developed 200-mr personnel dosimeter. Individual components were redesigned for maximum compatibility, with the reliability of the final product as the ultimate goal. Many of the problems encountered during the construction phase of the project are reviewed along with their solutions. A mathematical analysis of light transmission through the dosimeter is included as an aid for further study and development of the present optical system. A detailed processing procedure is carefully delineated to insure that the meter can be mass produced. The processes used in the construction of this meter are the most advanced state of the art and were tried and proven in practice. (auth)

20626 (AD-269307) UNIVERSITY OF CHICAGO PROPORTIONAL COUNTER TELESCOPE EXPERIMENT FOR EXPLORER VI AND PIONEER V. Final Report. (Chicago Univ. Labs., for Applied Science). June 25, 1960. For Space Technology Labs., Inc., Los Angeles. Subcontract No. 26-59508-SC. 24p. (STL/TR-60-0000-02166)

The description and performance of a proportional counter telescope for measuring cosmic radiation in the vicinity of the earth are discussed. Results are presented of trapped and cosmic radiation measurements from Explorer VI and Pioneer V. These measurements give information on the structure of the trapped radiation, solar induced changes, high-energy solar flare protons, and the existence of disordered magnetic fields in the planetary medium. (N.W.R.)

20627 (AEEW-R-132) A NOTE ON THE THEORETICAL SIGNAL TO NOISE RATIO OF THE TRANSFER FUNCTION ANALYSER. J. D. Cummins (United Kingdom Atomic Energy Authority. Reactor Group. Atomic Energy Establishment, Winfrith, Dorset, England). Dec. 1961. 14p.

Theoretical expressions for the signal-to-noise ratio of the modulus and phase of a frequency response as measured by the transfer function analyzer are developed. (auth)

20628 (ANL-6499) THE MEASUREMENT OF ENERGY AND INTENSITY OF GAMMA RAYS BY USE OF A SCINTILLATION SPECTROMETER. R. T. Julke, J. E. Monahan, S. Raboy, and C. C. Trail (Argonne National Lab., Ill.). Apr. 1962. Contract W-31-109-Eng-38. 95p.

The analysis of gamma-ray spectra measured with a scintillation counter with an anticoincidence annulus is described in detail. In particular the problem of the determination of the energy and intensity of gamma rays from such measurements is considered. The shapes of the full-energy peaks in observed complex spectra are studied and an attempt is made to justify their description in terms of a Gaussian response function. The details of the statistical analysis of complex gamma-ray spectra are given and, finally, procedures which have been used to confirm the validity of error estimates in energy and intensity measurements are described. (auth)

20629 (BNL-699) THE PHYSICS OF SEMICONDUCTOR RADIATION DETECTORS. Brookhaven Lecture Series No. 9. G. L. Miller (Brookhaven National Lab., Upton, N. Y.). Sept. 27, 1961. Contract [AT(30-2)-Gen-16]. 19p.

The discussion concerns the operation and mechanism of semiconductor detectors. Diagrams and other illustrations are included. (J.R.D.)

20630 (CERN-62-1) ANALYSE THEORIQUE DE L'ASSERVISSEMENT DU IEP 3. (Theoretical Analysis of Control of IEP 3). M. de Baets (European Organization for Nuclear Research, Geneva). Jan. 3, 1962. 117p.

The theoretical bases for the automatic following of tracks projected on a screen, beginning with the analysis of the "IEP 3" instrument for the evaluation of photographs, are presented. In the first part of the report the mechanical and optical aspects of the IEP 3 are described. The essential control components of the device are studied in the second part. (J.S.R.)

20631 (CVNA-140) EVALUATION OF REMOTE, MOTOR-OPERATED INSTRUMENT VALVES FOR FLOW MEASUREMENT AND SAMPLING SYSTEM. D. F. Winters (Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh). Apr. 1962. For Carolinas-Virginia Nuclear Power Associates, Inc., Charlotte, N. C.). Contract [AT(30-1)-2289]. 55p.

Four types of bellows-seal air-actuated valves and one canned-type solenoid-actuated valve were tested under simulated plant operating conditions. Mechanical tube fittings, hand shut-off valves, and differential pressure transmitters were also tested as part of the test rig. The test results provided the basis for recommending solenoid-actuated valves for the CVTR flow measurement and sampling system. (auth)

20632 (DC-59-6-743) CALIBRATION OF P102 NUCLEAR SENSORS. Gerald St. Leger-Barter and M. C. Halleck (General Electric Co. Aircraft Nuclear Propulsion Dept., Idaho Falls, Idaho). June 30, 1959. Contract AT(11-1)-171. 56p.

Included are brief descriptions of the test equipment and procedures. Curves of the current-voltage and count rate-pulse height selector setting characteristics are shown and the average current and count rate sensitivities are tabulated. (J.R.D.)

20633 (DC-59-10-202) FABRICATION OF CHROMEL A VERSUS 875 ALLOY THERMOCOUPLES. J. W. Glasgow (General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati). Nov. 13, 1959. Contract AT(11-1)-171. 27p.

A guide in the fabrication of metallic sheathed thermocouples made from Chromel-A and 875 alloy is presented. Two configurations were considered: a surface temperature measurement thermocouple and an air temperature measurement thermocouple probe. (auth)

20634 (DP-692) TRANSISTOR CIRCUITS FOR REMOTE BF_3 COUNTERS. L. Earl Weisner (Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.). Apr. 1962. Contract AT(07-2)-1. 9p.

A high gain pulse amplifier and a count rate meter were designed and constructed for use with a transformer-coupled pulse transmission circuit to count neutrons by means of a BF_3 counter at a remote location. A pulse transformer matches the impedance of the cable with that of the amplifier, eliminating the need for a preamplifier at the counter location. Si transistors in the amplifier and count rate circuits provide high reliability and tolerance to ambient temperatures up to 60°C. (auth)

20635 (ISS-61/7) EFFICIENZA GEOMETRICA DI REVELAZIONE IN UNA ESPERIENZA DI FOTOPRODUZIONE SINGOLA DI MESONI NEUTRI DA IDROGENO. (Geometric Efficiency of Detection in an Experiment of Single Photoproduction of Neutral Mesons in Hydrogen). A. Reale (Italy. Istituto Superiore di Sanità, Rome). [196?]. 21p.

The processing of the experimental results from measurements of the differential cross section for the photoproduction of neutral mesons in hydrogen is considered. The experimental set-up is first briefly sketched. The approaches used in the data processing are then reviewed. The basis for the computer calculation and the computer programming are given. (J.S.R.)

20636 (ISS-61/17) PROGRAMMA PER IL CALCOLO DI UN TELESCOPIO DI RANGE (CALCOLATORE IBM 610). (Program for the Calculation of Telescope Range (IBM 610 Computer). G. Cortellessa and A. Reale (Italy. Istituto Superiore di Sanita, Rome). 1961. 28p.

A program for the calculation of proton telescope range is reported. The program is composed of two distinct parts. The first is of a strictly kinematic nature and is used for the determination of the kinetic energy of protons emitted at assigned angles for random values of the energy of the incident particle. In the second part the general problem for the determination of the energy of a particle emitted at a given laboratory angle in a reaction with two particles is resolved with a consideration of the mass of the reacting particles and the total energy and pulse of the system. (J.S.R.)

20637 (JAERI-1030(Suppl.)) THE CONSTRUCTION AND PERFORMANCE OF THE JAERI NEUTRON CRYSTAL SPECTROMETER. (Japan Atomic Energy Research Inst., Tokyo). Mar. 1962. 36p.

The reflectivity of NaCl and Be single crystals for slow neutrons, Bragg angle (θ) vs neutron energy for the (200) plane in the LiF single crystal, reflectivity of the LiF single crystal for slow neutrons, and efficiency curves for BF_3 counters in various conditions are discussed. (M.C.G.)

20638 (JINR-D-870) THE APPEARANCE OF A DISCHARGE IN A SPARK CHAMBER ALONG A PARTICLE TRACK. A. A. Tyapkin and Chu-liang Ts'ou (Tsou Chzhulyan) (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Nuclear Problems). 1962. 11p.

The conditions of obtaining a discharge inclined to the field along an ionizing particle track in a gas discharge chamber with electrodes of aluminum foil without dielectric layers between the electrodes and the working volume of the chamber were investigated. If an ionizing particle passed the chamber, a spark discharge occurred only at the place the particle passed up to 18 kv. However, with the absence of a particle, a spark discharge occurred between the middle electrode and the box wall beginning from 15 kv. The effectiveness of the registration of cosmic particles passing the chamber was measured with the amplitude of a 10 kv pulse supply with various delays of a high voltage pulse and with various voltages of the clearing field. Data indicated that a discharge in the chamber arises only from electrons produced by a cosmic particle. (M.C.G.)

20639 (JINR-P-869) O NEKTORYKH OSOBENNOSTYAKH KINETICHESKIKH URAVNENII. (On Singularities in Kinetic Equations). M. I. Podgoretskii (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of High Energy). 1962. 15p.

Kinetic equations are examined where conditions can be described by one parameter. It is noted that usually these equations are solved completely and the initial conditions are then applied to get answers to specific problems. In many cases this leads to very complicated mathematics. In the case of linear systems, for which the conditions for the principle of superposition apply, the equations can sometimes be formulated with the initial conditions in mind, and lead to considerable simplification. The paper treats the case of an ion chamber, and the method is illustrated by this example, with the current in the chamber as the pertinent parameter. Further, the Townsend discharge is treated, and the gas cascade whose particles can diffuse across the discharge. The question of deadtime in a gas counter is considered, and formulas for it are presented for various intensities of incident radiation. (TTT)

20640 (LAMS-2697) THERMAL CALIBRATION OF THE CONVERTED PEEWEE NEUTRON SURVEY INSTRUMENT. Dale E. Hankins (Los Alamos Scientific Lab., N. Mex.). Jan. 1962. Contract W-7405-eng-36. 14p.

A thermal calibration of the converted PeeWee neutron survey instrument was made with the thermal flux from the Los Alamos Sigma Pile and the Los Alamos Water Boiler Reactor. The converted PeeWee was found to be rate-dependent even to relatively small thermal fluxes. The correction factor to be applied to the bare tube thermal reading varies because of this rate dependence; however, a value of 0.17 was selected to be applied for routine monitoring. The boron-lined tube presently used on the converted PeeWee cannot be replaced with a BF_3 tube without making a new fast neutron response curve for the BF_3 tube. The upper limit of measurement of the thermal neutron flux of the instrument is about 4 mrem/hr. (auth)

20641 (NP-11616) THE STATUS OF THE SCINTILLATION CHAMBER. Technical Report No. 6. Martin L. Perl (Michigan. Univ., Ann Arbor). Mar. 1962. Contract Nonr-1224(23). 12p.

A discussion is presented concerning the usefulness of the scintillation chamber in relation to the spark chamber. Experiments in which the scintillation chamber was used are also discussed along with experiments in which the luminescent chamber is useful. A discussion of techniques in the use of the various apparatuses is included. (J.R.D.)

20642 (NP-11663) FURTHER WORK ON AN IMAGE INTENSIFIER-SCINTILLATOR DEVICE FOR DETERMINATION OF PROFILES AND IMAGES OF WEAK BEAMS OF HIGH ENERGY PARTICLES. Technical Report No. 5. Dale Dickinson (California. Univ., Berkeley. Lawrence Radiation Lab.) and Martin Perl (Michigan. Univ., Ann Arbor). Mar. 1962. Contract Nonr-1224(23). 7p.

The use of a channeled particle-image converter in determining the intensity profiles of low intensity high energy charged particle beams is described. Good results were obtained. (M.C.G.)

20643 (NP-11691) CÁMARA DE IONIZACIÓN PARA ESPECTROMETRIA ALFA. INFORME NO. 64. (Ionization Chamber for Alpha-particle Analysis. Report No. 64). R. T. Bonard, G. A. Dupetit, R. A. Gayoso, and M. Lara (Argentina. Comisión Nacional de Energía Atómica, Buenos Aires). 1962. 16p.

A parallel-plate gridded ionization chamber for alpha-particle group analysis is described. The chamber operates with welding grade argon gas at over atmospheric pressure purified by hot (350°C) calcium turnings in a double purification system. Amplified pulses from the chamber are fed in a single-channel spectrometer with a variable channel width from 0.2 to 2 volt (50% geometry is attained for uncollimated samples). Radium-226 vacuum-sublimated samples are used to calibrate the equipment. The obtained resolution (total peak width at half-heigth) is 85 kev for the radium-226 peak and 75 kev for the radon-222 peak, using radium-226 vacuum-sublimated samples mounted on stainless steel disks. (auth)

20644 (TID-15702) RADIATION MEASUREMENTS BY FREQUENCY VARIATION. Eugene Dale Denman (Oak Ridge National Lab., Tenn.). June 1955. 40p.

Thesis submitted to Vanderbilt Univ., Nashville.

The method of measuring ionizing radiation by frequency variation of a radiofrequency oscillator was studied with the object of producing an instrument which will read radiation dose rates down to 7.5 Mr/hr or lower. Consideration was given to nonlinear (ferroelectric) capacitors, moving vane electrometers, and nonlinear (ferrite) inductors as the reactance varying element. The apparatus consisted of the oscillator containing the variable reactance element and equipment to receive and measure the frequency of the oscillator signal. The theory of capacitors with variable dielectric constant is discussed. Construction and performance of a nonlinear capacitor and ion chamber are described. The theory and construction of a nonlinear inductance is also discussed. The performance of the moving vane electrometer as a radiation detector is described. Dose rates of 10 Mr/hr were measured and found to be reliable when using a ferroelectric instrument. (M.C.G.)

20645 (TID-15742) DETECTION OF VERY LOW ENERGY ELECTRONS IN A BETA-RAY SPECTROMETER (thesis). Arthur W. Smith (Vanderbilt Univ., Nashville). [nd.]. 73p.

Means whereby beta particles at 1 to 20 kev may be detected at the exit pupil of a beta spectrometer are investigated. Results of a literature survey are given and an evaluation of various techniques is included. Experimental work on the use of film windows for use in the G-M detector is reported. It was found that properly supported films as thin as 1.5 $\mu g/cm^{-2}$ are usable. (J.R.D.)

20646 (TRG-Report-261) GAS-FILLED THERMOMETER FOR THERMOCOUPLE CALIBRATION. C. E. Hale (United Kingdom Atomic Energy Authority. Reactor Group, Risley, Lancs, England). Mar. 6, 1962. 17p.

The thermometer is to be used as a master for calibrating sample thermocouples in site in the H.E.R.O. reactor. The accuracy of the thermometer is ±¼°C in the range 0 to 500°C. (J.R.D.)

20647 (WT-1485) AERIAL-MONITORING OPERATIONS DEVELOPMENT. Fred R. Rehm (Office of Civil and Defense Mobilization, Battle Creek, Mich.). Mar. 1961. Project 36.4 [of] Operation PLUMBBOB. 26p.

Operations were conducted in Plumbbob operation to obtain information by aerial, automotive, and ground monitoring radiological surveys for the purpose of evaluating and correlating the data and methods. Correlations were developed for the CDV-710 meter which permit aerial readings as ground-level radiation intensities. However, development of a more suitable instrument is recommended for aerial monitoring. (J.R.D.)

20648 (XDCL-59-2-722) TEST PROGRAM FOR P-102 ION CHAMBER CALIBRATION AND ENDURANCE TEST. T. Brekken (General Electric Co. Aircraft Nuclear Propulsion Dept., Idaho Falls, Idaho). Feb. 20, 1959. 10p. Contract AT(11-1)-171.

The test program for 9 ion chambers in the MTR is discussed. Calibration of 3 uncompensated, 3 compensated, and 3 fission chambers is described. Endurance test procedures on one of each type of the chambers are given. (M.C.G.)

20649 (FTD-TT-62-480) THE DUOPLASMATRON AS AN INJECTOR OF IONS OR ELECTRONS OF EXTREMELY HIGH EMISSION-CURRENT DENSITY. M. von Ardenne. Translated from Exptl. Tech. Physik, 9: 227-35(1961). 14p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 16, abstract no. 14944.

20650 (NP-tr-894) ION SOURCES. Horst Loeb and Arthur Scharmann. Translated by L. F. Secretan (U.K.A.E.A. Atomic Energy Research Establishment, Harwell, Berks, Eng.) from Kerntechnik 4: 1-7(Jan. 1962). 28p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 16, abstract no. 11820.

20651 COMPENSATION TYPE WATER FLOW CALORIMETER FOR INTENSE ELECTRON BEAMS. I. CASE OF 1.0–1.8 Mev ELECTRON BEAMS. Shigeru Okabe, Kunihiko Tsumori, Keisuke Kawabata, and Kyue Fukuda. Ann. Rept. Radiation Center Osaka Prefect., 2: 43-7(1961). (In English)

A special compensation-type water flow calorimeter was designed and constructed to measure the output up to the maximum power of 7.5 kw of a 15-Mev electron linear accelerator. The calorimeter was tested with an electron beam from a Van de Graaff generator at the ranges of 20 to 200 watts and 1.0 to 1.8 Mev, and good agreement was found between injected beam power and the measured power. The efficiency and errors are discussed. (D.L.C.)

20652 ON THE SECONDARY ELECTRON MONITOR FOR ENERGIES BELOW 20 Mev. I. CASE OF 1.0–1.8 Mev ELECTRON BEAMS. Shigeru Okabe and Tatsuo Tabata. Ann. Rept. Radiation Center Osaka Prefect., 2: 48-53(1961). (In English)

The characteristics of the secondary electron monitor were studied with the electron beams in the energy range 1.0-1.8 Mev. Proportionality of the secondary electron current up to 120μa was verified and the monitor output showed a slight energy dependence. Insertion of the monitor in the beam path may cause an admixing of secondary electrons in the primary beam, but the upper limit to the ratio of this admixing is estimated to be about 0.6% of the beam current. (auth)

20653 NONOBSTRUCTIVE ELECTRON BEAM MONITOR FOR IRRADIATION. Shigeru Okabe, Tatsuo Tabata, and Rinsuke Ito. Ann. Rept. Radiation Center Osaka Prefect., 54-5(1961). (In English)

A modified secondary electron monitor was developed for monitoring electron beams. An Al window is utilized as the emitter of secondary electrons, and only one extra Al foil needs to be inserted in the beam path. The monitor was found to have an output proportional to the primary beam current up to 120μa and almost independent of the beam energy in the 1.0 to 1.7 Mev range. A qualitative explanation of the energy independence of the monitor output is given. (D.L.C.)

20654 NUCLEAR GYROS. W. H. Culver (RAND Corp., Santa Monica, Calif.). ARS (Am. Rocket Soc.) J., 32: 943-5 (June 1962).

Proposals for using the direction of orientation of aligned nuclei as a direction reference are discussed. The performance of a nuclear gyro tends to be degraded by relaxation effects, which cause the aligned nuclei to become randomly oriented by interaction with external magnetic fields, causing the orientation of the nuclei to change by interaction with the interrogation system. Enclosing the aligned nuclei in a superconducting shield greatly reduces the effect of external magnetic fields. A number of proposed interrogation schemes and their limitations are discussed. (auth)

20655 CONTRIBUTION TO THE QUANTITATIVE EVALUATION OF GAMMA SCINTILLATION SPECTROGRAMS. PART II. M. Geisler and G. Brunner (Institut fur Angewandte Radioaktivät, Leipzig). Atomkernenergie, 7: 60-5(Feb. 1962). (In German)

For activity determinations from scintillation spectrograms, relationships between the size of the spectrogram, the measurement conditions, and the activity of irradiator must be known, so that the spectrometer can be calibrated with respect to the intensity. A method permitting the activity of individual gamma emitters to be determined absolutely is described. This method was developed as the basis of the absolute calibration of the spectrometer. (tr-auth)

20656 DOSE SENSITIVITY OF GEIGER-MÜLLER-COUNTERS FOR X-RAYS AND GAMMA RAYS. PART I. K. H. Weber (VEB Vakutronik, Dresden). Atompraxis, 8: 182-7(May 1962). (In German)

In evaluating the possible uses of Geiger-Müller-counters for radiation-protection measurements in the field of x rays and gamma rays, the energy dependence of dose sensitivity, i.e., the number of impulses pro roentgen, is important. A relation was derived for the case of a homogeneous beam for cylindrical and spherical counters under simplified conditions. This relation permits a simple calculation of the dose sensitivity of counters as dependent upon quantum energy, if the absorption coefficients of the wall material and filling gas, and the ranges of the secondary electrons are known. (auth)

20657 THE LIMITS OF VALIDITY OF CAVITY IONIZATION THEORY. T. E. Burlin (Hammersmith Hospital, London). Brit. J. Radiol., 35: 343-8(May 1962).

The range of ionization chamber size to which theoretical treatments can be usefully applied is considered. The smallest size of chamber for which the Spencer-Attix theory is valid is determined by the slow electron transfer phenomenon and can be expressed mathematically: This, however, is not possible with the largest size of chamber for which theory is valid. The practical limitations of the Spencer-Attix theory are tabulated. Since the Bragg-Gray theory is based on a more approximate model than the Spencer-Attix theory and deviates more from experiment than the Spencer-Attix theory, it is convenient to express its limitations by comparison with the Spencer-Attix theory. (auth)

20658 A PLASTIC PHOSPHOR WELL COUNTER FOR SAMPLE VOLUMES UP TO 400 ml. G. T. Warner and R. Oliver (Radcliffe Infirmary, Oxford). Brit. J. Radiol., 35: 349-52(May 1962).

A scintillation counter using a plastic phosphor well is described in which the count rate is satisfactorily independent of a sample volume for 10 to 410 ml. Its efficiency and sensitivity are some 25 and 2 to 4 times greater, respectively, than for a counter using 32 small G.M. tubes. The use of the counter with Fe^{59}, I^{131}, and Cr^{51}, is discussed with particular reference to both urine and faecal samples and whole-body counting of small animals. It is not suitable at present for double isotope counting. (auth)

20659 WELL-LOGGING TECHNIQUE TO PROBE MOON. Leon H. Dulberger. Electronics, 35: No. 23, 28-9 (June 8, 1962).

A subsurface geophysical probe for lunar measurements is described. Instrumentation for measuring ionized interplanetary gas, lunar surface texture, vlf propagation in space, and an x-ray band radar for space rendezvous are provided. (L.N.N.)

20660 NEW IDEA IN COUNTING: INCREMENTALLY MAGNETIZED CORES. J. D. Freeman (General Time Corp., Stamford, Conn.). Electronics, 35: No. 24, 40-3 (June 15, 1962).

The Incremag, a multi-phase magnetic counting element which has proven itself in rigorous missile and space applications, is described. Stable pulse counts to 16 are obtained over wide temperature and supply voltage ranges using a single core. (L.N.N.)

20661 PROBES FOR PLASMA RESEARCH WITH WIDEBAND INTEGRATORS. S. Berglund and S. Westerlund (Univ. of Uppsala). Electronics, 35: 44-5(June 15, 1962).

A wideband integrator design based on a compensated R-C circuit similar to the bootstrap integrator or circuits produced by Puckle and Holbrook is described. Diagrams of the basic integrator, complete integrator circuit, simplified feedback pair circuit, and the line-driving amplifier are given, and the measured low-frequency response is illustrated in graphical form. (L.N.N.)

20662 HIGH-POWER MICROWAVE SOURCE USES PARALLEL KLYSTRONS AND FLYWHEEL. Laurence D. Shergalis. Electronics, 35: No. 24, 46-9(June 15, 1962).

A microwave power amplifier design enabling single or parallel operation to 4 klystrons at C band and feeding of a modified ring resonator to provide up to 100 Mw output is described. Time delays in the modulator circuit and phase shifters in the r-f circuit synchronize beam and r-f pulses to permit parallel operation of the klystrons. The r-f output circuit combines the output of each klystron in a high-power hybrid. Monitoring and protective circuits are illustrated. Pulses are fed into the microwave flywheel from the source in phase with the energy in the ring. The proposed low-pressure arc-discharge gaseous-shutter output switch is made as a part of a waveguide section. (L.N.N.)

20663 CADMIUM SULFIDE γ-RADIATION DETECTORS. N. G. Drozdov, N. I. Gorelov, B. S. Savashkevich, and A. I. Kukarin. Elektrichestvo, No. 1, 49-51(Jan. 1962).

Samples of CdS detectors with a high Co^{60} γ-radiation sensitivity were obtained by sublimating CdS powder on a heated conductive base layer which acted as one of the detector electrodes; the second electrode was deposited on a prepared layer of CdS by vacuum vapor deposition. The investigation of several samples gave the following results. A 1.5-cm^2 photosensitive layer 1 mm thick has an average sensitivity of 100 to 300 μamp/r/hr at a 10-v electrode voltage. Certain samples displayed a sensitivity of 500 to 700 μamp/r/hr. There was good linearity in the relationship of photocurrent to γ-radiation intensity (up to 500 r/hr). The detectors may be useful in dosimetry in cases where their slow response can be tolerated. The comparatively high sensitivity of CdS detectors also makes possible their use for direct recording of photocurrents and in relay circuits without additional amplification. CdS detectors are recommended also as γ relays in automatic systems operating under the action of γ or x radiation (an x irradiation with 90 kev increases sample sensitivity to Co^{60} about 15 times). (OTS)

20664 A STUDY OF FALLOUT IN TAIWAN. Liag-han Chou, Yuen-shu Hsin, and Li-Jan Cheng (Ordnance Research Inst., Taipei, China). Ho Tsu K'o Hsueh, 2: No. 4, 49-54(1960). (In Chinese)

The adhesive tape technique using a synthetic adhesive instead of vaseline was used for collecting fallout dust. The tape, after exposure, was burned to ash and the radioactive ash was tested in steel counting planchets. The counting efficiency of the counting tube was calibrated with potassium carbonate which has a known disintegration rate of 840 d/min/g. All samples were studied 24 hr after exposure. Dating of nuclear explosions were made by using both the law $I = k \cdot t^{-1.2}$, and a technique developed at the laboratory by using a law $I_t = I_0 \cdot t^{-x}$, where I_t is the activity at the time t, I_0 the initial activity immediately after ex-

plosion and x, an empirical constant to be determined. Some known explosions were not detected because of the limited dimensions of the collecting device. (TTT)

20665 PHOTOGRAPHY OF SLOW NEUTRONS. Kwan-han Suen, Fa-yueh Woo, and Tze-su Kuo (National Tsing Hua Univ., Taipei, Japan). Ho Tsu K'o Hsueh, 3: No. 1, 6-13(1961). (In Chinese)

Photographic emulsions are sensitive to photons and particles bearing electric charges but not to neutrons. To photograph neutrons a backing screen made of materials which would produce radioactivity through neutron capture is necessary, e.g., B(n,α), Cd(n,γ), In(n,γ), Rh(n,γ); rhodium (Rh) has been the most favored material. The rare earth metals dysprosium (Dy), gadolinium (Gd), samarium (Sm) and a specially prepared boron phosphor were tried with a 25 mc Ra–Be neutron source. The sensitivities are compared and listed according to the darkness of the exposed films under identical conditions. The order is: B–phosphor > Gd_2O_3 > Dy > Sm_2O_3 > Rh. (TTT)

20666 INVESTIGATION ON THE MANUFACTURING OF THE PORTABLE GEIGER COUNTER. Heng-yueh Li, Bingyork Ouyang, Chen-chun Tu, Tse-yun Ho, and Kwo-chyung Chen (Ministry of Economics, United Industrial Research Inst., Taipei, Japan). Ho Tsu K'o Hsueh, 3: No. 1, 38-57(1961). (In Chinese)

The portable Geiger counter is chosen as the first radiation measuring instruments to be developed and manufactured by the institute. The functions and applications of radiation counters and their required electronic circuits are briefly outlined. Two types of Geiger counters sensitive to beta- and gamma-radiations have been worked out. Miniature vacuum tubes instead of the special vacuum tube as used in "foreign" made counters were developed and installed in both types of counters to minimize the price and to facilitate repairs and replacements. One type consists of an institute-made counter tube and an amplifier circuit of three tubes (2–1 T4, 1–3S4), and a 5" loudspeaker as the indicator. It is suitable to be used as a radiation detector or monitor. The other type comprises the same counter tube, a univibrator circuit of two tubes (2–1S5) and a 50 micro-ammeter as the indicator. Both are calibrated against a standard source of Co-60, the normal ranges are 0-1 and 0-10 mr/hr for uranium prospecting and radiation protection. For the urgent need of the civil anti-air-raid training, the range is extended to 500 mr/hr at a sacrifice of the linearity. The d-c power supplies are the Victoreen vibrator power supply 517c. With the exception of the regulation tubes all other parts are made in the institute. The testing and calibration methods for the parts are also described. (TTT)

20667 4π-β-γ COINCIDENCE COUNTING FOR THE CALIBRATION OF NUCLIDES WITH COMPLEX DECAY SCHEMES. H. Houtermans and M. Miguel (International Atomic Energy Agency, Vienna). Intern. J. Appl. Radiation and Isotopes, 13: 137-42(Mar. 1962). (In English)

The 4π-β-γ coincidence calibration is normally used only for nuclides with decay schemes which are both reasonably well known and fairly simple. It is shown that by a systematic variation of the mean β-efficiency α_m (the ratio of the coincidence to the γ-counts) the error caused by the self-absorption of the β-rays can (in 4β-π counting) be eliminated by an extrapolation method. This is possible even for very complex and uncertain decay schemes, provided that a least one β-γ cascade is known. The results of a calibration of a solution of Ce^{144} + Pr^{144} are reported as an example. (auth)

20668 UNPURIFIED CARBON DIOXIDE AS A FILLING GAS FOR COUNTERS. B. Kalab and E. Broda (Universität, Vienna). Intern. J. Appl. Radiation and Isotopes, 13: 191-203(Apr. 1962). (In English)

It is shown that using suitable electronics it is possible to obtain good plateaus with counters filled with unpurified CO_2 without addition of foreign gases. For instance, at a pressure of 300 torr the plateau has a length of 600 v and a slope of 0.35%/100 v only. At 760 torr the values are 1200 v and 0.25%/100 v. The influences on the plateau of the amplification, of electronic quenching, as well as of added air, water vapor, benzene vapor or carbon disulfide vapor were examined. Estimates of the gas amplification as a function of applied voltage are presented. The simplicity of the procedure and the quality of the plateau make possible the rapid, precise, and sensitive routine assay of radiocarbon by the method described. (auth)

20669 UTILIZATION OF A THIN LAYER OF CsI(Tl), OBTAINED BY VACUUM DEPOSITION, AS DETECTOR OF FISSION FRAGMENTS. Ludwik Kowalski and Wilfrid Sébaoun (Faculté des Sciences, Orsay, France). J. phys. radium, 23: 62(Jan. 1962). (In French)

The response of a CsI(Tl) foil to fission fragments and to α particles was studied. The foil was mounted directly on a photomultiplier. The results show that the response of the scintillator foil to α particles does not differ from the response to crystals, and the resolution obtained is the same. The response of the scintillator foil to fission fragments is much better than that obtained of crystals. (J.S.R.)

20670 AUTOMATIC DATA PROCESSING FOR A SENSITIVE TIME-OF-FLIGHT MASS SPECTROMETER. B. R. F. Kendall (National Research Council, Ottawa). J. Sci. Instr., 39: 267-72(June 1962).

A small all-metal time-of-flight mass spectrometer is described. The instrument gives usable resolution up to mass 60 and has the advantages of simplicity and high sensitivity. Many of the limitations of this type of mass spectrometer were overcome by means of built-in systems for automatic processing of the output data. In this way the partial-pressure detection limit was reduced to 5×10^{-13} mm Hg and the maximum sampling rate for any one gas increased to approximately 10^5 partial-pressure measurements per second. Other systems make possible the display and recording of complex changes in gas composition. A brief description is given of an analogue device with which large increases in effective power were obtained. (auth)

20671 DIRECTIONAL COUPLER IN OVERSIZE WAVEGUIDE. D. J. H. Wort (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Sci. Instr., 39: 317(June 1962).

The use of oversize waveguides, with suitable electroformed tapers where transition to the standard size was required, in experiments where microwaves are used to investigate plasmas is discussed. A directional coupler developed for use with the oversize guide is described. (M.C.G.)

20672 A METHOD OF MEASURING THE ACTIVITY OF BETA-RADIATION SOURCES BY MEANS OF SPHERICAL IONIZATION CHAMBERS. A. D. Turkin. Med. Radiol., 7: No. 4, 76-8(Apr. 1962). (In Russian)

Data concerned with the description of a method for measuring the activity of beta sources with the aid of spherical ionization chambers are given. (auth)

20673 γ-SPECTROMETRY COMPENSATED FOR THE COMPTON EFFECT. D. De Soete and J. Hoste (Univ. of Ghent). Nature, 194: 859(June 2, 1962).

Studies were made on the compensation of the Compton effect using either an anthracene crystal or a plastic scintillator. It was found that an even better compensation for the Compton edge was obtained with the plastic scintillator along with a detector cost reduction by a factor of approximately 50. For the spectrum compensated with the plastic scintillator, the detectors were at an angle of 90° and mounted in lead collimators. When mounted at an angle of 180°, the backscatter extends up to the 500 kev region, whereas at an angle of 90° a reduction in backscatter by a factor 3 is obtained. The detection efficiency, caused by the lead collimator, is reduced by 20% only. (P.C.H.)

20674 THE STATUS OF SILICON JUNCTION NUCLEAR PARTICLE DETECTORS. R. L. Williams and P. P. Webb (RCA Victor Research Labs., Montreal). Neue Tech., 4: 187-91(Apr. 1962). (In English)

Nuclear particle detectors are now available which give linear response for protons with energies up to 12 Mev. The 5 mm^2 units which operate up to 400 v have resolutions for 660 kev Cs^{137} electrons of 9 kev. The best resolution for alpha particles was realized using thin diffused regions. For a unit having a 0.2 micron diffusion depth, resolutions as low as 17 kev are obtained with Am^{241} alpha particles. The voltage rating of units with detecting areas of 2 cm^2 is at present limited to about 200 v. The resolution obtained for alpha particles with such units depends on amplifier design but values of 50 to 70 kev are readily obtained. The resolution of all units has its best value near the maximum operating bias voltage. Curves of resolution as a function of bias for the various types of unit illustrate this point. The dead layer of a unit is a function of the diffusion depth used in forming the junction. Measurements of this dead layer using optical methods and nuclear particles are compared. The use of charge amplifiers is an accepted practice with silicon junction detectors if the highest resolution is to be obtained in a drift free system. General operating characteristics of such amplifiers are briefly discussed along with a mention of the best rise and clipping times for particular detector types. (auth)

20675 AUTOMATIC DEAD-TIME CORRECTOR IN RADIATION MEASUREMENT DEVICES. Thomas Friese (Hahn-Meitner-Institut für Kernforschung, Berlin). Nukleonik, 4: 67-71(Mar. 1962). (In German)

The errors caused by the dead-time in the measurements of statistically distributed pulses can be eliminated or reduced with automatic correction methods. In count meters an error corrector is possible through appropriate calibration or utilization of an electrodynamic quotient measuring device. Compensation recorders permit an exact correction. In rate meters the correction is achieved through production of pulses during the dead-time, in counters with electronic clocks by measurement of live time. Dead-time stages were given for both types of solutions. (tr-auth)

20676 A TRANSISTORIZED DECADE OF AN ELECTRONIC COUNTER. Roman Śledziewski (Inst. of Physics, Krakow). Nukleonika, 7: 123-6(1962). (In Polish)

Circuit diagrams, output and input pulse parameters, and other properties are outlined for a transistorized decade scaler. Its input and output pulses are 1.5 and 3.8 v respectively; its counting rate is 50 kc; its pulse rise and fall times are 14 and 17 μsec respectively; it has a power dissipation of about 0.4 w; and its dimensions are about 115 × 60 × 45 mm. (T.F.H.)

20677 THE GRAIN-DENSITY OF EMULSION TRACKS. J. W. Patrick and W. H. Barkas (Univ. of California, Berkeley). Nuovo cimento (10), 23: Suppl. No. 1, 1-16 (1962). (UCRL-9692). (In English)

Measurements of the true grain density were made using methods on the tracks of electrons, pions, K mesons, protons, Σ hyperons, and α particles. The curve of grain density vs velocity in K-5 emulsion was obtained. The results found by different objective methods and by differen observers agree. Due to the finite density of silver-halide crystals in the emulsion, the grain-density saturates. The nature of the saturation effect was studied. A decompositio of the grain-density into primary and secondary component was made. Even at the minimum of grain density, about 25 of the grains are of secondary origin. Since only the primary grains are affected by the relativistic rise of the grain density, the interpretation of the plateau/minimum grain density ratio is affected. Observations of the grain density in the relativistic region were made, avoiding temperature, fading, and development-difference effects. A rise to the plateau of 18% in the primary grain density was found. This implies a mean excitation potential for AgBr of 442 ev. Indices measuring emulsion quality are suggested. (auth)

20678 THE CRYSTAL SPECTROMETER FOR THE DIFFRACTION OF NEUTRONS INSTALLED AT THE ISPRA CENTER. G. Caglioti, E. De Agostino, F. Marsili, A. Paoletti, U. Pellegrini, and F. P. Ricci (Comitato Nazionale per l'Energia Nucleare, Rome). Nuovo cimento (10), 23: Suppl. No. 1, 17-27(1962). (In Italian)

The crystal spectrometer for neutron defraction installed at the Ispra-1 reactor is described. Typical diffraction patterns obtained are presented and discussed. (auth)

20679 A COMPUTER METHOD FOR THE ANALYSIS OF FLASH TUBE DATA. R. M. Bull, D. W. Coates, W. F. Nash, and B. C. Rastin (Univ. of Nottingham, Eng.). Nuovo cimento (10), 23: Suppl. No. 1, 28-38(1962). (In English)

Flash tube techniques are applied in the detection of charged particles. In all cases, the location of a particular trajectory with the highest possible accuracy is required. Speed is important when large numbers of events are analysed. A computer method, developed and used successfully in the analysis of events from a flash tube μ-meson spectrograph, is described. (auth)

20680 THE DESIGN OF FLASH TUBE ARRAYS. R. M. Bull, D. W. Coates, W. F. Nash, and B. C. Rastin (Univ. of Nottingham, Eng.). Nuovo cimento (10), 23: Suppl. No. 1, 39-51(1962). (In Italian)

The computer method of analysis enables a more complete investigation of the design considerations of flash tube arrays for use in location of particle trajectories. Results are presented giving the effects of variation in the array parameters (e.g., gas pressure, number of layers of tubes, and tube sizes and location) on the error in angular measurement. (auth)

20681 NOTES ON A SIMPLE MICROPHOTOGRAPHIC METHOD FOR MEASUREMENTS OF "JETS." T. Jacobse (Univ. of Oslo). Nuovo cimento (10), 23: Suppl. No. 1, 52-4(1962). (In English)

A method of constructing target diagrams of the core of jets in photographic emulsion is described. A sequence of microphotographs of the jets is taken and projected onto a paper. They are all drawn on the same paper, and the target diagram is found by applying simple projecting drawing. (auth)

20682 SIGNAL-TO-NOISE CONSIDERATIONS IN A NUCLEAR MAGNETOMETER. G. Faini and O. Svelto (Istituto di Física del Politecnico, Cattedra di Elettronica Nucleare, Milan). Nuovo cimento (10), 23: Suppl. No. 1, 55-66(1962). (In English)

The accuracy in relative measurements of magnetic fields using a nuclear magnetometer depends basically on the signal-to-noise ratio in the sensing coil. This ratio is evaluated as a function of the coil's geometrical parameters, and graphs which allow the optimum geometrical dimensions to be chosen are shown. It is possible to build a coil showing an effective signal-to-noise ratio of 540 at the amplifier output, with a sensing volume of water of 160 cm^3 (amplifier bandwidth ≈10 Hz). (auth)

20683 THE H_2 BUBBLE CHAMBER USED AS A LOW-ENERGY NEUTRON SPECTROMETER AND THE APPLICATION OF THIS TECHNIQUE TO THE DETERMINATION OF THE PANOFSKY RATIO. M. Pyka (Univ. of Chicago). Nuovo cimento (10), 23: Suppl. No. 1, 112-31(1962). (In English)

A hydrogen bubble chamber was used as a neutron spectrometer for 8.9-Mev radiative neutrons emitted in the capture of π^- mesons by protons. These neutrons were detected by observing their recoil protons, and their energy was derived from the angles and ranges of the recoils. The neutron energy spectrum thus obtained exhibited a sharp peak (full-width at half-maximum of ~0.7 Mev) at the correct energy. Two independent techniques were used to subtract background from this peak; they yielded the same result. The absolute detection efficiency was calculated from the known n-p cross-section and the dimensions of the chamber by a Monte-Carlo technique. When the net count in the energy peak is corrected by the detection efficiency and compared to total number of pions stopping in the chamber 1.53 ± 0.10 is obtained for the Panofsky ratio. The neutron energy spectrum was analyzed to determine the mass of the π^- meson, yielding: $m_{\pi^-} = (273.0 \pm 0.8)m_e$. The technique may be extended to neutron energies of ~3 Mev. (auth)

20684 THE ACCURACY OF TRACK LOCATION IN TRIGGERED SPARK COUNTERS. M. G. Thompson and A. W. Wolfendale (Durham Coll., Eng.). Nuovo cimento (10), 23: Suppl. No. 1, 144-9(1962). (In English)

Studies were made of the accuracy with which the spark in an air-filled triggered spark counter reproduces the trajectory of the triggering particle. For a single counter, the rms displacement is 1.54 mm, and the median displacement is 0.4 mm. Using a 6-layer counter and a large displacement cut-off technique, the rms error of track location is reduced to 0.38 mm, and the median displacement to 0.2 mm. (auth)

20685 THE INFLUENCE OF HEATING ON FADING IN NUCLEAR EMULSIONS. E. Dahl-Jensen and E. Skrzypczak (Univ. of Copenhagen). Nuovo cimento (10), 23: Suppl. No. 1, 150-3(1962). (In English)

Exposed Ilford K-5 pellicles were kept for 4 hr at 20 to 60°C to investigate the acceleration of fading with temperature. Results indicate that the processed sensitivity is changed little by this treatment, the only detectable effect being a slight change of the grain diameters. (auth)

20686 THE BASIC DESIGN DATA OF A GUARDED-FIELD THIMBLE IONIZATION CHAMBER. AN ANALOGUE INVESTIGATION. Barry Barber (London Hospital Research Labs.). Phys. in Med. Biol., 6: 259-70(Oct. 1961).

The potential distribution in various guarded-field ionization chambers was obtained from a Resistance Network Analog and shown to be in agreement with previous analytical and numerical work. The opportunity was taken to investigate the potential in a typical peg-type chamber, and the results emphasized a number of disadvantages of this type of chamber. The analog also provides a means of improving the design of the peg-type chamber. Finally, a simple technique was described which enables the collecting volume for the guarded-field chambers to be obtained directly from the analog, and the data obtained by this technique are shown to be in good agreement with the analytical data deduced previously. (auth)

20687 DETECTION OF TRITIUM WITH A FILM DOSEMETER. J. A. B. Gibson (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Phys. in Med. Biol., 6: 283-6(Oct. 1961). (AERE-M-770)

Exposure of the Harwell film dosimeter to tritium as HTO results in an equivalent film dose which is proportional to the exposure to tritium and to the storage time before developing. From measurements of the blackening of the film and a knowledge of the storage time, the dose to a man wearing the film can be estimated. Calibration of the films to an accuracy of ±30% is given over the range 0.1 to 2.5 rem, corresponding to tritium-in-air activities in the range 100 to 20,000 picocuries/cm^3. (auth)

20688 SURFACE DOSE MEASUREMENTS WITH A SCINTILLATION DOSEMETER. G. L. Olde and E. Brannen (Univ. of Western Ontario, London). Phys. in Med. Biol., 6: 325-7(Oct. 1961).

A scintillation dosimeter was constructed for energetic electrons that allows a point-by-point measurement of the absorbed dose. Design and performance features are described. (C.H.)

20689 DETEKTORY YADERNYKH IZLUCHENII. (Nuclear Radiation Detectors). E. I. Dolgirev, P. I. Maleev, and V. V. Sidorenko. Leningrad, State Publishing House of Ship Building Industry, 1961. 224p.

The performance, properties, design, construction, installation, and testing of various types of radiation detectors are analyzed. Specifications are given for gas discharge counters, phosphors, and photomultipliers. Some data are also included on nuclear emissions and units of measurement. 79 references are included. (R.V.J.)

20690 LINEAR AND LOGARITHMIC AMPLIFIERS FOR SINGLE AND PLURAL ELECTRODE IONIZATION CHAMBERS. Robert Lewis Carlson and Cecil Annand Crafts (to Robertshaw-Fulton Controls Co.). British Patent 895,297. May 2, 1962.

A drift-free circuit is designed for linear or logarithmic amplification of the output signal from a gamma-compensated ionization chamber of the plural electrode type. In this circuit, square-wave excitation potentials are applied to the chamber electrodes on opposite sides of the collector electrode so that the differential signal indicating the neutron flux level is in the form of a square wave with an amplitude double that of the d-c signal normally obtainable. The signal is then amplified by an a-c amplifier. (D.L.C.)

20691 IMPROVED APPARATUS FOR EXAMINING RADIOACTIVE SAMPLES. John Richard Angwin Lakey (to Simon-Carves Ltd. and General Electric Co., Ltd.). British Patent 897,852. May 30, 1962.

An apparatus is designed for examining radioactive samples by presenting them in sequence to a counter. The apparatus comprises a counter enclosed in a shield with an aperture, an endless tape for moving the samples past the aperture at a uniform speed, and means for rendering the counter operative when a sample reaches the aperture. The means comprises a microswitch and stops on the tape for operating the switch. A scaler, ratemeter, and recorder are included in the counting circuit. Some of the possible applications of the apparatus are described. (D.L.C.)

20692 DEVICE FOR SELECTIVELY DETECTING THE OCCURRENCE OF FISSION PRODUCTS IN GASES. Jean Goupil and Andre Roguin (to Commissariat à l'Énergie Atomique). British Patent 898,219. June 6, 1962.

A device is designed for the selective detection of short-lived fission products in a gas flow. The device comprises a detection chamber, means for circulating part of the gas flow through the chamber, detecting means, means for storing a first signal, and means for comparing the first signal with a second signal produced a predetermined time after the first signal. The device is especially adapted for detecting burst slugs in a gas-cooled reactor. (D.L.C.)

20693 IMPROVEMENTS IN OR RELATING TO APPARATUS FOR MEASURING THE RADIOACTIVITY OF THE AIR. (to G. A. Messen-Jaschin). British Patent 899,084. June 20, 1962.

An apparatus for measuring the total radioactivity of air is designed which can carry out measurements in a continuous manner. The apparatus comprises a separation chamber, means for flowing an air stream through the chamber, a separating electrode in the form of a band driven through the chamber parallel to the air stream, means for generating ions in the stream and for providing an electrical field in the chamber, and a detector located adjacent the band and beyond the chamber for measuring the radioactivity of particles deposited on the band. (D.L.C.)

20694 DEVICE FOR SUPERVISING THE CONCENTRATION OF RADIO-ACTIVE SUBSTANCES CONTAINED IN A MEDIUM. (to Landis and GYR A.G.). British Patent 899,971. June 27, 1962.

A device for continuously monitoring air for radioactivity of long life is designed with means for giving early warning of high concentrations of long-lived radioactivity in the air. The device comprises a moving strip for receiving a deposit of the radioactive substances from an air flow at a collecting station, a radiation detector at a great distance therefrom to permit the decay of the short-lived activity, and two radiation detectors near the collecting station. One of the near detectors is directly above the collecting station, while the other detector is at a distance less than the length of the collecting station. (D.L.C.)

20695 APPARATUS RESPONSIVE TO THE COMPOSITION OF A GASEOUS MEDIUM. Robert Guilleux (to Societe a Responsabilite Limitee la Detection Electronique Francaise). U. S. Patent 3,028,490. Apr. 3, 1962.

The design and characteristics of a device responsive to the composition of a gas are described. The device is of the type wherein variations in the composition induce corresponding variations in the ionizing current flowing through an ionizing chamber exposed to the gas being tested. The device may be used as fire detectors, furnace combustion controllers, and automatic chemical process controllers, to name a few. The device consists of an ionization chamber including a conductive outer cylinder maintained at ground potential, an insulating inner cylinder coaxial therewith, a cathode, a radiant source and an anode all supported in the chamber from the insulating cylinder, a screen grid supported from the insulating cylinder in a downstream relative to the anode and maintained at an adjustable potential negative with respect to the anode potential, means for delivering gas to be tested through the chamber, a scaled reference ionization chamber having a cathode electrically connected to a common junction with the anode of the first chamber, so as to provide at the junction a potential depending on the composition of the gas, and control circuit systems connected with the junction and responsive to the potential for operating output apparatus in accordance therewith. Additional features are also described which may be employed by the device. (N.W.R.)

20696 ELECTRICAL COUNTING CIRCUITS. Jack Bryant (to United Kingdom Atomic Energy Authority). U. S. Patent 3,037,118. May 29, 1962.

A circuit for counting electrical pulses from a detector is designed which automatically compensates for the dead-time loss of events. The circuit includes means for generating a second series of pulses which are delayed by a fixed amount of time from the pulses corresponding to the events detected, gate means for accepting pulses of the second series during dead-time periods, and means for adding the accepted pulses to the pulses corresponding to detected events. (D.L.C.)

20697 TEMPERATURE-REGULATED WELL-LOGGING APPARATUS. Serge A. Scherbatskoy. U. S. Patent 3,038,074. June 5, 1962.

A temperature-regulated well-logging apparatus including a scintillation counter is designed for use in deep wells where temperatures may rise to 375°F or more. The apparatus houses the counter and sensitive electronic components in a double-walled heat-insulating jacket with a sealed space between the walls filled with a finely divided heat-insulating solid and within the interior jacket a mass of a material which undergoes a reversible heat-absorbing physical change at a high temperature, e.g., melting at 100°F. Means are provided for cooling the apparatus rapidly after use to ambient temperature when required. Several embodiments of the apparatus are described. (D.L.C.)

20698 METHODS AND MEANS FOR COMPENSATION OF DENSITY LOGGING INSTRUMENTS. Arthur H. Youmans (to Well Surveys Inc.). U. S. Patent 3,038,075. June 5, 1962.

A gamma well logging subsurface instrument for measuring the density of rock formations is designed which substantially eliminates the borehole effect. The instrument has two detectors, one for gamma logging and the other for measuring the borehole effect, and the output of the second detector is subtracted from that of the logging detector. (D.L.C.)

20699 RADIOACTIVITY WELL LOGGING CALIBRATING SYSTEM. Serge A. Scherbatskoy (to PGAC Development Co.). U. S. Patent 3,038,076. June 5, 1962.

A neutron well logging system for obtaining neutron and gamma ray logs is designed with means for calibrating the neutron portion of the instrument without interference from background radiation or from the gamma ray portion of the instrument. (D.L.C.)

20700 AUTOMATIC CONTROL FOR PROGRAMMING SAMPLE CHANGING IN RADIATION DETECTING SYSTEM. Walter P. Kern. U. S. Patent 3,038,078. June 5, 1962.

An automatic system for counting successive samples is designed in which the sample itself programs its own removal from the detector in the event that its counting rate falls outside a normal, preset range. The system comprises a detector, a magazine of holders, a sequence control, and a program control for causing the sequence control to operate when the radioactivity of a sample within the detector falls within a preset range. The program control includes a counter, a timer, and comparators. (D.L.C.)

20701 ORIENTATION OF NUCLEAR MAGNETIC RESONANCE SAMPLES. William F. Mueller (to Socony Mobil Oil Co., Inc.). U. S. Patent 3,038,115. June 5, 1962.

A sample spinning unit is designed for orienting a thin-walled cylindrical film or sample in a magnetic field for nuclear magnetic resonance measurements without dis-

turbing the magnetic field outside the sample. The unit is made of non-magnetic materials and is useful for providing a sharp reference line in the resonance spectrum for studies of unknown samples. (D.L.C.)

20702 IONIZATION MEASUREMENT INSTRUMENT. Rudolf Futterknecht (to Nassau Distributing Co., Inc.). U. S. Patent 3,038,995. June 12, 1962.

A radiation detector, consisting essentially of an ionization chamber and an electron gun whose beam is directed onto a fluorescent screen, is designed so that it may be used as a pocket instrument without radiation hazard. The electron gun of the detector has a tritium-containing source, and a brief connection is made between the housing of the electron gun and the central electrode of the ionization chamber in addition to a connection between deflecting plate and electrode when the detector is in the ionizing ray or particle field to be measured. (D.L.C.)

20703 NUCLEAR MAGNETIC RESONANCE MEASURING DEVICE. Kenneth E. Francis and Clyde W. Pinkley (to Industrial Nucleonics Corp.). U. S. Patent 3,039,046. June 12, 1962.

An improved sample holder is designed for a nuclear magnetic resonance apparatus. The sample holder permits the manipulation of both the coil and sample relative to the magnet pole faces and has electrostatic and magnetic flux shielding to prevent pickup of stray radiation. (D.L.C.)

20704 SPECTROMETER. Rollie B. Williams (to Esso Research and Engineering Co.). U. S. Patent 3,039,047. June 12, 1962.

A nuclear magnetic resonance spectrometer is designed for comparing directly a pair of samples. The samples are positioned in one or two inductance coils, and the coils are wound so that the induced voltages are in phase opposition to produce a voltage differential. (D.L.C.)

20705 NUCLEAR MAGNETIC RESONANCE MEASURING AND CONTROL DEVICE. Clyde W. Pinkley. U. S. Patent 3,039,049. June 12, 1962.

A nuclear magnetic resonance measuring apparatus is designed with means for preventing loss of resonance with respect to a particular nucleus under test. The means comprises an electronic feedback control for controlling the frequency of the r-f field in response to the intensity of the magnetic field. (D.L.C.)

20706 NUCLEAR ELECTRONICS. VOL. I. Proceedings of the Conference on Nuclear Electronics Held at Belgrade, 15-20 May 1961. (International Atomic Energy Agency, Vienna). Proceedings Series. Apr. 1962. 606p. (STI/PUB/42(Vol.I)). $11.00(IAEA).

Of the 61 papers published in this volume of the Proceedings, ten were previously abstracted in Nuclear Science Abstracts. The remaining 50 are abstracted separately. (L.T.W.)

20707 SCINTILLATION PROPERTIES OF PURE ALKALI HALIDES AT LOW TEMPERATURES. H. V. Watts, L. Reiffel, and M. D. Oestreich (Armour Research Foundation, Chicago). p.3-15 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In English)

Fragmentary studies in various laboratories on the scintillation behavior of several of the alkali halides, both with and without impurity activators, indicate that in general the activated alkali halides scintillate best at room temperature with pulse-height decreasing at lower temperatures, while the unactivated materials scintillate best at low temperatures and decrease in efficiency as the temperature increases. A systematic research study on the scintillation properties of the alkali halides was undertaken, and twelve pure (unactivated) alkali halides were studied with both α-particle and γ-ray excitation over the temperature range 4 to 300°K. LiI, KI, and CsI exhibit a constant scintillation pulse-height and decay-time at temperatures below 80°K. NaI exhibits a maximum in pulse-height at 60°K. A CsI sample shows both a low-temperature scintillation-component and a room-temperature component similar to that induced by overheating. RbI shows two regions of linearly decreasing pulse-height as temperature increases. The scintillation pulse-heights of the iodides are comparable to that observed from thallium-activated sodium iodide, and the decay times are about 0.1 to 2 μs. CsBr, KBr, and NaCl scintillate at low temperatures, but with a much lower intensity than the iodides. LiF, NaF, KCl, and RbBr exhibit no detectable scintillation over the entire temperature range studied. The temperature dependence of pulse-heights and decay-constants is the same for both γ- and α-excited emission. Analysis of the scintillation pulse-shape and the temperature-dependence gives an indication of the number of luminescence components and the mode of decay of the excited luminescence centers. (auth)

20708 IMPROVED ORGANIC SCINTILLATION DETECTORS. J. B. Birks (Univ. of Manchester, Eng.). p.17-26 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In English)

Equations have been derived for the practical scintillation efficiency (photo-electrons/Mev) of organic crystals and solutions in terms of molecular parameters, and these have been applied to the more important scintillator systems, for photomultipliers with S11 (glass window) and S13 (quartz window) responses. The results suggest several improvements in current organic scintillation detector practice: the use of binary rather than ternary solutions; the use of quartz rather than glass windows; and the reconsideration of mixed crystal scintillators based on naphthalene. Improvements by factors of 2 or more in the figure of merit (practical efficiency/decay time) for fast-scintillation counting can be obtained. (auth)

20709 LIQUID SCINTILLATION COUNTERS FOR REGISTERING NEUTRONS. I. Vizi, G. P. Zhukov, et al. p.27-36 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In Russian)

One of the main methods employed in slow-neutron spectrometry is the time-of-flight method. Two detectors intended for time-of-flight work are described, a neutron detector for measuring total cross sections and a capture gamma-ray detector for measuring radiation-capture cross sections and self-absorption cross sections. How the detectors are used and the results obtained with them are indicated. (auth)

20710 A GASEOUS COUNTER FILLED WITH He^3 FOR NEUTRON SPECTROMETRY. S. A. Baldin and V. V. Matveev. p.37-45 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In Russian)

A gas plant and gaseous scintillation counter are described, and the results of experiments on the recording and spectrometry of neutron beams using a gaseous scintillation counter filled with a mixture of 10% xenon and 90% He^3 at an over-all pressure of 20 atm are given. Data are given on the design of the gas plant, which makes it possible to operate the counter continuously over long periods of time, as well as providing the required gas mixtures at over-all pressures of up to 60 atm and ensuring constant freedom of the gas from contamination. The results of re-

search on the counter's energy resolution and linearity at different energy levels are presented, and its efficiency in gamma fields of intensity up to 3 r/h is indicated. The possibility of extending the working energy-range of gaseous scintillation counters filled with He^3 is also considered. (auth)

20711 A LARGE CERENKOV DETECTOR. F. Reines and C. C. Giamati (Case Inst. of Tech., Cleveland). p.47-54 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In English)

Several problems, e.g., a test of nucleon conservation and high-energy neutrino detection, have led to the construction of a large Cherenkov detector. This device consists of a tank 2.4 m in diameter and 2.1 m high which is painted with a white reflecting coat. The 7400-l water volume used as the filling at present is viewed from above by 52 type-6364 Dumont multiplier phototubes. Internal to the detector as it is being currently used is a 200-l liquid scintillation-counter enclosed in an 8000-kg Fe shield. Constructional details and the response of the detector using cosmic-ray muons as a probe are described. Results are presented on the effectiveness of the detector as an anti-coincidence blanket and the relevance of these numbers to the question of detecting high-energy neutrinos, both cosmic and man-made. (auth)

20712 DETECTION OF THE CERENKOV EFFECT OF β PARTICLES IN A LIQUID BY RAPID PHOTOMULTIPLIERS IN COINCIDENCE. R. Ducros and G. Ducros (Centre d'Études Nucléaires, Saclay, France). p.55-61 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In French)

An electronic assembly in the nanosecond region was studied for the detection of weak light pulses due to the Cherenkov effect, which an ordinary photomultiplier represents by pulses of a level comparable to that of the thermal noise at ambient temperature. The elimination of these extraneous counts was effected by rapid coincidence between two photomultipliers viewing the same source of light. This arrangement, eliminating the cooling normally used in this type of detection, permits a significant reduction of the volume and weight of the apparatus used with the Cherenkov detector proper. The apparatus described has been applied to the detection of β-emitters in solution; it has permitted the measurement of Sr-Y activity in water, in concentrations at the MCP level. (auth)

20713 THE NON-PROPORTIONAL RESPONSE OF NaI(Tl) TO γ-RAYS AND ELECTRONS AND ITS EFFECT UPON THE CRYSTAL RESOLUTION. P. Iredale (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.87-94 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In English)

Measurements have been made of the scintillation efficiency (light output L, per unit energy input, E) for γ rays absorbed in NaI(Tl) crystals. The results were sufficiently accurate to allow the evaluation of dL/dE for γ rays and hence to demonstrate the variation of dL/dE with density of ionization along the path of the photo-electrons ejected by the primary γ rays. The resolution of a crystal for the total absorption of γ rays was shown to vary in a similar way to previously published results. Experiments indicated that variations throughout a crystal in the efficiency of light collection do not appreciably affect the resolution. Owing to the nonproportional response of NaI(Tl) to electrons, the light output resulting from the total absorption of a γ ray varies according to the number and energy of electrons amongst which its energy is distributed. Approximate calculations show that this effect makes a considerable contribution to the anomalous crystal resolution. (auth)

20714 SOME EFFECTS OF TEMPERATURE ON THE PERFORMANCE OF SCINTILLATION COUNTERS. J. F. Cameron, C. G. Clayton, and R. A. Spackman (Wantage Research Lab., Berks, Eng.). p.95-110 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In English)

Increasing industrial application of scintillation counters has focused attention on those factors governing stability, resolution, and speed of response. The effects of temperature are considered. The mean and single-pulse light output of a number of phosphors have been examined. In sodium iodide there is not a continuous change. It has been shown that below 20°C the height of the photo-peak decreases with decreasing temperature whereas the mean current increases. Above 20°C the mean current decreases as the temperature increases and the photo-peak amplitude remains unchanged. Similar effects have been observed in other phosphors. The time-response of light output in sodium iodide has also been examined over the temperature range +60°C to −60°C. The magnitude of these effects depends on the dose rate and the total dose delivered to the phosphor. Explanations are associated with temperature dependence of radiationless transitions and with metastable states in the phosphor. Using light from a sodium iodide crystal and observing mean current and photo-peak amplitude, venetian blind type photomultipliers with SbCs photo cathodes exhibited a decrease in gain with increase in temperature. The gain variations include short and long time-constant components, the former due to direct thermal effects on the electrodes and the latter to cesium migration within the tube. The photocathode has been shown to contribute about one-half of the total observed effect. (auth)

20715 A XENON–HELIUM GAS-SCINTILLATION COUNTER. K. Bergheim and K. Skarsvag (Institutt for Atomenergi, Kjeller, Norway). p.111-14 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In English)

A gas-scintillation counter is developed. The gas is a 10% xenon and 90% helium mixture and is streaming through. The counter is used for discrimination between the heavy and the light fission fragment. (auth)

20716 CERIUM-ACTIVATED VITREOUS SCINTILLATORS FOR NEUTRON DETECTION. V. K. Voitovetskii and N. S. Tolmacheva. p.127-30 of "Nuclear Electronics Vol. I." Vienna, International Atomic Energy Agency, 1962. (In Russian)

The results of measurements on the resolving times and scintillation efficiency of cerium-activated silicate glasses are given. The authors show the effect of the Ce concentration on the scintillation efficiency of glass assaying $Li_2O \times 0.5\ CaO \times 0.13\ Al_2O_3 \times 4\ SiO_2$. The effect of temperature on efficiency was determined in the range −50°C to +50°C. It was found that throughout the entire temperature range the efficiency is constant within the limits of measurement. The scintillation efficiency of glass assaying $1.5\ Li_2O \times 0.13\ Al_2O_3 \times 4\ SiO_2 \times 0.06\ CeO_2$, in which 0.1 molecules of lithium had been replaced by other alkaline or alkaline-earth elements, is also indicated. (auth)

20717 PLASTIC SCINTILLATORS FOR RECORDING THERMAL NEUTRONS. E. E. Baroni, D. V. Viktuzov, et al. p.131-8 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In Russian)

The method of thermal polymerization was used to produce plastic scintillators on a polystyrene base with a hig

concentration of lithium salts. The scintillators are intended for recording thermal neutrons. Scintillation spectra have been obtained for thermal and fast neutrons and for gamma rays. Analysis of these spectra shows that the efficiency for recording thermal neutrons is many times greater than the efficiency for recording fast neutrons or gamma quanta: with a 10% concentration (in weight) of lithium carbonate (90% Li^6) and a scintillator thickness of 4 mm an efficiency of 26% can be obtained for recording thermal neutrons, while the efficiency for recording fast neutrons (Po–Be) is 0.6% and that for gamma quanta (Co^{60}) 0.2%. (auth)

20718 A SLOW NEUTRON SCINTILLATION COUNTER INSENSITIVE TO GAMMA RADIATION. I. V. Kirpichnikov. p.139-41 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In Russian)

A slow neutron scintillation counter is described; the detector consists of a mixture of dihydrodecaborane with zinc sulfide. The recording efficiency for neutrons is 10% at a neutron energy of 1 ev and about 1.5 to 2% at an energy of 50 ev. The counter is almost completely insensitive to gamma radiation. (auth)

20719 AN IMAGE-INTENSIFIER SYSTEM FOR THE STUDY OF RARE DECAY MODES OF ELEMENTARY PARTICLES. K. Lande, A. K. Mann, K. Reibel, and D. H. White (Univ. of Pennsylvania, Philadelphia). p.145-52 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In English)

Filamentary chamber-image intensifier systems have been developed which yield pictures of charged-particle tracks which are limited in spatial resolution only by the unit filament size, and which exhibit a time-resolution of about one microsecond. This device, used in conjunction with auxiliary particle counters, is well suited to the study of rare decay modes of elementary particles such as, for example, π- and K-mesons. The method employs a filamentary chamber divided into two or more regions. In one of the regions the incident mesons stop and subsequently decay. The other regions are traversed by the decay products. One face of the chamber is viewed by the image-intensifier system and the opposite face is viewed by photomultiplier tubes, one for each of the separate chamber regions. It is required to trigger the image intensifier systems that a counter telescope, including one of the chamber photomultipliers, indicates that a meson has stopped in the proper region, and also that appropriate delayed coincidences obtain between that stopping event and pulses from the other chamber photomultipliers which indicate the passage of a decay particle. Under these conditions the event is photographed and, in addition, the time sequence of the several counter outputs is available for recording. The system is capable of utilizing a large-incident meson current and accepts decay-product particles over a large solid angle. The counter selection procedure limits the number of photographs necessary to observe a given decay mode and facilitates the extraction of useful data from the photographs that are taken. Such a system, with a two-section chamber 2 in. × 2 in., has recently been employed in a measurement of the lifetime of the π^+ meson and in a preliminary attempt to observe directly the decay mode, $\pi^+ \rightarrow \mu^+ + \nu + \gamma$. The lifetime measurement was intended mainly to investigate sources of background in this technique in preparation for later experiments, including further measurements of π- and K-meson lifetimes. By appropriate selection criteria, the triggering of the system due to $\pi^+ \rightarrow \mu^+ + \nu + \gamma$ with a branching ratio of about 10^{-4} relative to $\pi^+ \rightarrow \mu^+ + \nu$ was enhanced by approximately the ratio of the muon to pion lifetime. With about 3.5×10^3 pions stopping in the chamber per minute, the system recorded an average of about 5 events per minute for a total, based on preliminary scanning, of about 8×10^3 events satisfying criteria applied to both the space and time information. (auth)

20720 AN IMAGE INTENSIFIER SYSTEM. H. C. Burrows, Jr., D. O. Caldwell, E. V. Chitnis, J. Dowd, D. A. Hill, K. Li, and R. A. Schluter (Massachusetts Inst. of Tech., Cambridge). p.153-8 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In English)

On the basis of experience in operating large scintillation chambers at the Cosmotron, relative advantages of the plastic fiber and NaI types are discussed. The plastic chamber is 5 × 5 × 10 in. and is made up of ½ mm fibers, whereas the homogeneous chamber is a 4 × 6 × 6 in. block of NaI. The chambers could be viewed stereoscopically with two chains of light amplifiers, ending in intensifier orthicon cameras. Comparisons are also made between operating with light amplifiers only and using light amplifiers with a television system. The unique method employed of reading the subsequent track pictures into a computer is also described briefly. (auth)

20721 INTENSIFIER TUBE DEVELOPMENT. K. Coleman (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). p.159-63 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In English)

Butslov et al. (Proceedings of IV Congress on High-Speed Photography, Cologne, 1958) have published an account of their work on an Image Intensifier Chronograph useful in connection with spark counters. Comments are made on extensions of this technique with respect to different kinds of output, deflection, and shuttering. In particular some of the problems connected with multi-stage intensifiers are considered. As a result of some experience in experiments of this type an attempt has been made to make small-diameter fiber scintillators for both detectors and output screens. (auth)

20722 THE LUMINESCENT CHAMBER AND ITS USE IN HIGH-ENERGY PHYSICS EXPERIMENTS. L. W. Jones and M. L. Perl (Univ. of Michigan, Ann Arbor and Univ. of California, Berkeley). p.165-81 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In English)

A luminescent chamber has been employed for the first time in experiments in high-energy particle physics. At the Bevatron of the Lawrence Radiation Laboratory, particle tracks in activated sodium-iodide crystals were photographed using a cascade system of three-image intensifier tubes. In one experiment, elastic pion-proton scattering was studied using two arrays of scintillator, each 20 cm long, one to observe the scattered pion and the other the recoil proton from a liquid hydrogen target. Scintillation counters selected only nearly-coplanar events to be recorded; however, the final criteria for elastic scattering were the kinematics of the recorded tracks. About 1000 elastic events were photographed at each of three incident pion moments up to 2.5 Mev/c. In a second experiment a single-scintillator array $10 \times 10 \times 20$ cm^3 was used to observe stopping recoil protons from inelastic pion scattering (single pion production) at three incident pion momenta. Again several thousand events were recorded. The range and angle of the recoil proton uniquely determined the momentum transfer and the center-of-mass energy of the di-pion system which were the relevant kinematical pa-

rameters in this problem. In these experiments post-event triggering and five-microsecond time-resolution were achieved by gating the second image tube on a signal from the scintillation-counter electronics. The design and successful execution of these experiments are discussed, with particular reference to the relevant details of the image tubes, the scintillation counters, and the electronic systems. Experience has also been gained in the analysis of the track photographs, particularly regarding the accuracy obtainable and reliability of the physics thus obtained. In conclusion, the future evolution of the luminescent chamber is explored, considering the image intensifier tubes and scintillators under current development. The role of the luminescent chamber in future high-energy experiments is analyzed in relation to the spark chamber and other detectors. (auth)

20723 RECENT WORK ON CERENKOV IMAGE DETECTORS. G. R. Burleson, A. Roberts, and T. A. Romanowski (Argonne National Lab., Ill.). p.183-8 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In English)

The Cherenkov image-detector (CID) consists of a Cherenkov radiator, an optical objective that gives a ring-image of the Cherenkov light cone, and a system of cascaded image-intensifiers that provide an electronically amplified ring image at the output phosphor, bright enough to photograph. The detector has the advantages of not requiring a highly collimated beam, of allowing the simultaneous observation of several particles, and of providing highly accurate data on the direction and velocity of these particles. Some preliminary observations on the performance of the CID were made with an external pion beam from the Brookhaven cosmotron, using an intensifying system consisting of one WX-4047 (a single-stage intensifier with a 5-in. diam cathode), a 3-stage RCA C-73491 and an RCA C-73477 image-intensifier orthicon, with a television output that was amplified and photographed from the kinescope. It was shown that the system performance was of the order expected with regard to intensity, however, the resolution was considerably poorer than that anticipated from known properties of system components. Additional optical design work on objectives for CID systems now indicates that it should be possible to design radiator-objective mirror combinations covering different velocity ranges, and adapted to different purposes, including both survey work and precision measurements. (auth)

20724 WINDOWLESS PHOTOMULTIPLIERS: REALIZATION, STUDY OF THE PROPERTIES. A. Blanc, C. Jehanno, C. Julliot, and J. Vasseur (Centre d'Etudes Nuclearies, Saclay, France). p.189-200 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In French)

This study was undertaken in order to make measurements of radiations emitted by plasmas. The photomultipliers can be utilized for the detection of photons of the far ultraviolet ($100 \leq \lambda \leq 1500$ Å), electrons (50 ev to 10 kev), and low-energy ions (a few kev). The photomultipliers studied (14, 15, and 17 stages) are preceded by a target or by a photocathode adapted for the purpose, and can easily be connected to a vacuum chamber (operating pressure, 10^{-5} mm Hg). The total voltage is 4000 to 5000. A good gain stability is obtained with dynodes of Ag–Mg or Cu–Be alloys. The total gain as a function of voltage depends on the way in which the material is treated and seems to depend closely on the oxidation state. The coefficient of secondary emission as a function of the energy of the electrons (50 ev to 20 kev) for Cu–Be and Ag–Mg alloys, oxidized and non-oxidized, was determined. In the area of the ultraviolet under vacuum, the windowless photomultiplier has several advantages over a detector with a light converter (sodium salicylate): better time resolution, photoelectron/UV photon yield five times higher, insensitivity to visible light and the near UV, thermal background negligible, signal-to-noise ratio considerably higher. (auth)

20725 STUDY OF THE CHARACTERISTICS OF THE 56 AVP PHOTOMULTIPLIER IN THE TIME REGION BELOW ONE NANOSECOND. B. Agrinier, Y. Koechlin, and A. Raviart (Centre d'Études Nucléaires, Saclay, France). p.201-9 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In French)

In order to determine the response characteristics of type 56 AVP photomultipliers to ultra-short light pulses, the C.L.A.R.E. mercury relay was used as a light source and a time-amplitude converter of very high resolving power was introduced. A description is given of the electronic circuit, the intrinsic resolving power of which is 2.5×10^{-11} s. Used with two 56 AVP photomultipliers receiving the light pulses of the C.L.A.R.E. relay, its resolving power is 1.5×10^{-10} s. The transit time of the photomultipliers has thus been measured and also its variation from the center to the edge of the photocathode, together with its variations as a function of the potential of the focusing electrode. On reducing the light flux on one of the photomultipliers in such a way that it only receives one photon per spark of the C.L.A.R.E. relay, the fluctuations of the transit times of the photoelectrons in the structure between the photocathode and the first dynode can be measured. These fluctuations can be reduced to less than 5×10^{-10} s. An explanation of the influence of the electrode potentials is proposed. It is shown, in short, that the association of the 56 AVP photomultiplier with the electronic device described permits a definition of the form of all light pulses, the duration of which can be less than one nanosecond. (auth)

20726 EXPERIMENTS ON MULTI-STAGE LIGHT INTENSIFICATION BY ELECTRO-LUMINESCENCE. K. Owaki and T. Nakamura (Kobe Kogyo Corp., Okubo, Akashi, Hyogo, Japan). p.213-21 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In English)

In recent years, several papers on the solid-state image intensifier by the use of electro-luminescent phosphor and photo-conductive materials have appeared as one of the important applications of solid-state electronics. It is convenient and important to use the solid-state intensifier for light amplification. The purpose of this experimental work is to achieve more amplification by cascading the intensifier in multi-stage. The electrical and optical characteristics of a single-element light intensifier and the advantage of employing parallel resistance with an electroluminescent panel to improve its characteristics are reported. Two types of photo-conductive cell were used, one was a sintered CdS cell and the other a CdS photo-sensitive powder, molded with plastic binder. According to the results obtained on a single-element light intensifier, two-stage and three-stage light intensifiers were made and their characteristics were tested for various parallel resistances. In the three-stage light intensifier, the amplification of about 400 was obtained at 0.3 rlx in-put radiation, and these results suggest the possibility of obtaining more amplification at lower input radiation. The experimental results are believed to be applicable to a solid-state image intensifier by devising a suitable construction. (auth)

20727 DEVELOPMENT OF THE PHOTOMULTIPLIER FM 50 FOR STANDARD SCINTILLATION COUNTERS. E. Kansky. p.223-8 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In English)

The FM-50 is a tube with a plane, transparent Sb–Cs photocathode, 40 mm in diameter, and an eleven-stage Ag–Mg multiplying system designed for standard scintillation counting. The special form of the first and second dynode allows electrons to be collected from large photocathodes in a Reichmann system. The optimal secondary emission coefficient of Ag–Mg alloy is attained when MgO layers, produced in the selective oxidation process, are very thin; therefore, the dynode activation process can be simplified. The activation and sensibilization of the photocathode is discussed; a possibility of sensibilization with O_2 originating from a source incorporated in the tube is described. Some ways of stabilizing dark currents are discussed. The tube characteristics are given. (auth)

20728 A STUDY OF THE LOCAL CHARACTERISTICS OF PHOTOMULTIPLIERS. P. Cachon (Institut d'Études Nucléaires, Algiers), A. Sarazin, and A. Pascal. p.229-38 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In French)

Various devices for analyzing the local characteristics of photomultipliers (changes in transit time and variations in sensitivity from the point of view of the anode or of the cathode itself) are described. A device has been built with which it is possible, by means of a spiral sweep, to scan the entire surface of a photocathode with a succession of short luminous pulses supplied by a flying-spot. A cathode-ray tube is used to translate the data (differences in transit time or anode sensitivity) into a homothetic chart of the scanning or, in the case of radial scanning, into the form of Cartesian coordinates. Absolute measurements of the anode sensitivity can be made correct to 5%, and of differences in transit time correct to 2×10^{-10} s. Two continuous-operation instruments are in use. With one of them a photocathode can be scanned by a light-spot in a succession of diametral sweeps; the sweep is slow enough for the data (photocathode current or current from some other electrode) to be recorded on a potentiometric millivoltmeter. The second apparatus was designed to measure the continuous-current characteristics of photomultipliers; by measuring the anode current with the photocathode diaphragmed at various diameters it indicates the mean relative sensitivity of different annular zones of the photocathode. The test results presented are mainly for the following tubes: 53 AVP, 54 AVP, 56 AVP, and 58 AVP. (auth)

20729 EXPERIMENTS WITH A SPARK CHAMBER. B. Agrinier, B. Mougin, and B. Parlier (Centre d'Études Nucléaires, Saclay, France). p.241-5 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In French)

An experimental spark chamber was constructed with a usable volume of $7 \times 7 \times 5$ cm having six parallel 2-mm thick stainless steel plates. The distance between each plate is 8 mm. The chamber is filled with neon under a pressure of one atmosphere. On applying a pulse of about 10 kev on the plates immediately after the passage of a charged particle through the chamber, sparks form along the trajectory of the particle and may easily be photographed. The chamber was first used with cosmic ray μ mesons and then put into the π-meson beam of the SATURN synchrocyclotron. The efficiency of the chamber as a function of voltage and retardation of the applied electric pulse and the dead-time are given. The first results obtained with a chamber of 10-liter volume are also presented. (auth)

20730 A SPARK-CHAMBER SPECTROMETER. G. R. Burleson, A. Roberts, and T. A. Romanowski (Argonne National Lab., Ill.). p.247-60 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In English)

A program of developing techniques for the construction and use of spark chambers in high-energy physics experiments has been undertaken. Several methods of construction have been tested and found satisfactory. One method is to cement aluminum plates to frames made from glass or Plexiglas strips. Another is to place the aluminum plates in grooves machined in Plexiglas, forming a "shelf" design. A chamber made of rows of wires was successfully operated with a He–alcohol mixture. These chambers can either be filled with gas and sealed, or gas can be passed through them continuously. Chambers have been constructed with plates of various thicknesses ranging from 0.032 in. downwards. The operation of the chambers with various spacings between the plates was also investigated. The performance of these chambers, when filled with several different gases (Ne, He, Ar) and with gas–alcohol mixtures, has been investigated. Several methods of applying high-voltage pulses to the chambers have been attempted. The results of these investigations are presented. Spark chambers placed in a magnetic field can be used in principle to determine the momentum of charged particles and if lead converter-plates are incorporated with them, the resulting system should serve as a gamma-ray spectrometer of high resolution and high efficiency. A magnet with an 18-in. useful diameter and a 13,000-G field is being fitted with spark chambers, whose performance will be tested with cosmic rays and with an accelerator beam. Results from such tests are presented. (auth)

20731 A CYLINDRICAL SPARK COUNTER. A. Buffington, D. H. Frisch, D. A. Hill, and M. Wahlig (Massachusetts Inst. of Tech., Cambridge). p.261 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In English)

A parallel-plate spark counter consisting of an eight-gap array of coaxial cylinders surrounding a two-liter liquid hydrogen target is nearing completion. An optical system with some unusual features has been devised to permit a direct measurement of particle trajectories in cylindrical coordinates. The essential design features and test results are given. (auth)

20732 SPARK CHAMBER FOR RARE MODES OF MESON DECAY. H. L. Anderson (Univ. of Chicago). p.263-8 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In English)

A spark chamber–scintillation counter combination is described which makes effective use of the property of the spark chamber to preserve good angular resolution within a large solid angle to identify rare modes of meson decay. The branching ratios of the order of 10^{-8} for the modes $\mu^+ \rightarrow e^+ + \gamma$, $\pi \rightarrow \pi^0 + e + \gamma$, and $\pi \rightarrow e + \nu + \gamma$, are accessible with this arrangement. Prototype chambers have been built whose operating characteristics are described. (auth)

20733 STUDIES ON RADIATION-IMAGE DETECTORS. L. Reiffel (Armour Research Foundation, Chicago). p.269-84 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In English)

Work underway on radiation detectors capable of preserving spatial distribution information is described. Problems

of determining intensity distributions in a plane or possibly over a cylindrical surface are of interest. This class of problems includes neutron diffraction, neutron radiography, and x-ray and γ-ray radiography or scattering studies with these radiations. Emphasis is being given to imaging radiation detectors based on spark breakdown and on luminescence or stimulated phosphorescence. Very large spark counters were developed which weigh over 100 lb and have sensitive areas of about 2000 cm^2 defined by staggered planar arrays of up to 400 anode and cathode wires. Flow-counter operation using an air or argon-methane gas atmosphere provides an alpha-sensitive system and slow neutron detection is accomplished with enriched B^{10} converter plates. With other fill gases, proton and electron sensitivity has been demonstrated. Read-out of the intensity distribution is by photographic recording of the spark distribution. Neutron Laue patterns have been recorded in ten minutes using the Armour Research Reactor at low power; peak core flux was 10^{11} nv and the collimator was a straight 1 × 1 cm tube. Application of these counters to other neutron studies is described with comments on the ultimate resolution to be obtained with smaller electrode spacings, dynamic scanning and possibly space filtering of the optical image. A second general approach to radiation-image detection concerns the use of luminescent or phosphorescent converter screens. Matrices of luminescent fibers are being tested which comprise very thin glass tubes filled with liquid scintillator. These are useful in x-ray and γ-ray detection and either the wall materials or the core liquid may be "loaded" to obtain neutron sensitivity. New methods of fabricating various types of luminescent fiber screens are presented together with optical performance data also germane to scintillation-chamber technology. Possible imaging detectors using thick blocks of material which are capable of significant energy storage and stimulated phosphorescence upon irradiation are discussed briefly along with read-out methods using optical scanning beams to eliminate resolution loss due to finite phosphor thickness. (auth)

20734 PERFORMANCE, AT AMBIENT TEMPERATURE, OF IONIZATION CHAMBERS FILLED WITH A LIQUID DIELECTRIC. D. Blanc, J. Mathieu, and J. Boyer (Faculté des Sciences, Toulouse, France). p.285-96 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In French)

The performance characteristics of ionization chambers filled with carefully purified normal hexane are described. A detailed study of the background of a detector of this type enabled them to define the conditions in which it is possible to stabilize this background and to reduce it to about 10^{-14} a/cm^2, for a uniform electric field of 8000 v/cm. Under irradiation with alpha or gamma rays, and at laboratory temperature, the current which passes through the chamber is a linear function of the applied electric field, up to a critical field value which is a function of the degree of purity of the liquid. Above that critical value, a process of ion-multiplication takes place, somewhat similar to that which takes place in gases. The change in the ionization current then becomes exponential. In that area of multiplication the authors detected impulses by the passage of individual alpha particles. The low mobility of the ions in the hexane and their extensive recombination considerably limits the amplitude of the impulses, which can easily be confused with the amplifier's background if a certain number of precautions are not taken. Impulses were recorded with amplitudes varying between 2.5×10^{-5} and 25×10^{-5} v, and with growth-times between 2 and 20 μs in electric fields of 21,600 to 65,600 v/cm. A number of preliminary results for other liquid fillings are given. (auth)

20735 EXPERIMENTAL TECHNIQUES IN LOW-LEVEL ALPHA SPECTROMETRY. M. Nurmia (Univ. of Helsinki). p.297-302 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In English)

Several ionization chambers designed for the study of extremely weak alpha activities are described. Sources from one to 6000 cm^2 are used, and by special coincidence techniques a background value of less than 0.01 counts/channel (30 kev) per hour is achieved. The preamplifiers consist of one PCC 88 and one 6AK5 and photographic recording is used in most measurements. By careful stabilization an alpha-line with a half-width of less than 100 kev is routinely achieved in exposures lasting hundreds of hours. By using a clipping time-constant of about 1 μs, the alpha activity of sources containing 100 to 200 μg of beta activity can be studied. Under these circumstances an alpha branching of 10^{-8} to 10^{-9} is detectable. (auth)

20736 A NEW TYPE OF INSTRUMENT FOR THE STUDY OF THE ANGULAR DISTRIBUTION OF FISSION FRAGMENTS. R. Ramanna, R. Chaudhry, S. S. Kapoor, K. Mikke, S. R. S. Murthy, and P. N. Rama Rao (Atomic Energy Establishment, Trombay, India). p.303-12 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In English)

A gas scintillation counter in combination with a gridded ionization chamber has been developed to determine the angular distribution of ionizing particles with respect to a fixed direction. The cathode of the ionization chamber is coated with a thin layer of source material which emits ionizing particles under investigation. Pure xenon serves as an ionization gas of the chamber as well as a scintillator. A photomultiplier incorporated in the chamber observes the light emitted along the track of the ionizing particle, and gives a zero time pulse. The subsequent rise of the ionization pulse from the gridded ionization chamber gives the delay which determines the projection of the track length on the electric field. From the pulse height of the ionization pulse, the range of the track is determined. From knowledge of the range of the track and its projection along a fixed direction, the angular distribution of the ionizing particles is determined. To study the mechanism of prompt neutron emission in the fission process, this instrument has been used to determine the angular correlations of prompt neutrons of specified energies and fission fragments in the thermal fission of U^{235}. A fast neutron time-of-flight spectrometer has been associated with the above to measure the energies of the prompt neutrons by the time-of-flight technique. The fast neutron detector was placed along the electric field direction of the ionization chamber. The angular correlations of light fission fragments and prompt neutrons of specified energies have been obtained with the above arrangement. (auth)

20737 A SYSTEM OF INDICATING THE COORDINATES OF PARTICLE ENTRY INTO AN EMULSION CHAMBER (SCINTILLATION COUNTER (CUY-1)). A. S. Dvoretskii, R. A. Serebryakov, et al. p.313-20 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In Russian)

Using the photoemulsion method, it is very difficult to identify and separate particles of different types at energies of 10^9 ev and above. With Cherenkov scintillation counters it is possible to separate high energy particles, but not to observe the interaction of particles. To over-

come these drawbacks, an apparatus has been designed, based on the specific effect of analyzers and on the use of photoemulsion methods of investigating elementary particles. Apart from its main purpose (to facilitate the study of particle interactions), this CUY-1 scintillation counter gives a considerable saving in time as regards examination of the emulsion. The results of measurements with the apparatus and its technical characteristics are given. The accuracy of determination of the coordinates of particle entry into the emulsion chamber is not worse than ±0.5 mm; the efficiency of the apparatus is 90%. (auth)

20738 ELECTRICAL CHARACTERISTICS OF SPHERE-PLANE TYPE SPARK COUNTERS. P. Laborie and D. Blanc (Faculté des Sciences, Toulouse, France). p.327-33 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In French)

The mechanical construction and operating characteristics of spark detectors using a small (0.03 mm) diameter sphere as anode, set opposite to a plane cathode and working by the "corona" effect in air at atmospheric pressure, are described. Counting characteristics are very similar to those of Rosenblum-type anode wire detectors. However, the sphere counter has a certain superiority over the Rosenblum counter inherent in its geometry: (a) background is low and the release of ozone and nitrous oxides during the spark is not of great significance; (b) its self-capacity being very small, the detector gives a faster response; (c) unlike in the case of wire counters, efficiency is independent of particle incidence direction; (d) its sensitive volume, that of a solid of revolution around the axis of symmetry of the detector, amounts to a few cubic millimeters and, being very clearly defined, permits realization of accurate telescopic devices. (auth)

20739 A PROPORTIONAL COUNTER WITH REDUCED WALL EFFECT. C. Manduchi and G. Zannoni (CNEN and Università, Padua). p.335-8 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In English)

A proportional counter, using gaseous sources, in which the wall effects are considerably reduced, is described. The counter is fitted with a ring of internal shielding counters in anti-coincidence, separated from the main central counter only by a number of cathode wires. The counter can be readily assembled, giving flexibility in research investigations. Applications to a measurement of the L/K capture ratio in A^{37} and Fe^{55} are described. (auth)

20740 CONSTRUCTION AND OPERATING CHARACTERISTICS OF FLEXIBLE GEIGER COUNTERS. H. G. Richter and L. F. Ballard (Research Triangle Inst., Durham, N. C.). p.339-4 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In English)

A method has been developed for constructing flexible Geiger counters in a wide range of lengths and diameters. The counters are quite flexible: a 3-cm diam counter can be bent to a circle of 5 cm radius. Using Q-gas (98.3% helium, 1.7% n-butane) as the counting medium, plateaux are several hundred volts long with 3% slopes and are independent of the counter configuration. Counters are constructed from tubing having a polyvinyl-chloride formulation (PVC-744-Alpha Wire Corp.). Short segments of the plastic tubing (length ~3 times the tube diameter) are slipped over a coarsely threaded aluminum mandrel. Wire is wrapped tightly in the threads and the whole is placed in a 110°C oven for 20 min. After cooling, the corrugated plastic segment is removed from the mandrel. This corrugation prevents the collapse of the tubing when it is coiled. A polystyrene disk, perforated with relatively large holes near the periphery for gas flow and having a 0.6-mm hole in the center for the anode, is fastened in one end of each segment. By threading the segments thus prepared on a 3-mil tungsten anode and slipping one end of each segment over the adjacent segment and securing them with an adhesive, a counter of any desired length can be built up. Glass end-pieces for attaching the anode ends and for admitting and exhausting the flow gas are attached. A bare copper wire spiralled in the grooves of the counter makes a satisfactory external cathode. A 3-cm diam counter, 1 m long, either linear or coiled, has a plateau beginning at 1400 v and extending beyond 1750 v with a 2.9% slope. Counting rates in excess of 300,000 counts/min with little coincidence loss have been observed. Since the counter is actually a series of short Geiger counters and the discharge does not spread beyond the polystyrene spacer disks, adjacent counter segments operate independently. Pulse heights are greater than 50 mv. (auth)

20741 DEVELOPMENT OF GEIGER-MÜLLER COUNTERS FOR OPERATION AT HIGH TEMPERATURES. M. Drăghicescu (Inst. of Atomic Physics, Bucharest). p.345-52 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In French)

Counters of this type are necessary for radioactive logging at great depths; they have to operate normally at temperatures up to 180°C. In order to preserve their characteristics under such conditions, the work function of the cathode has been improved by a special treatment. Tests have been made on counters with graphite, copper, and wolfram cathodes in a glass envelope. The method is simple, and can easily be employed in industry. (auth)

20742 A STUDY OF THE POSSIBILITIES OF USING CADMIUM-SULPHIDE CRYSTAL COUNTERS. M. Borisov and M. Marinov. p.363-77 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In Russian)

The results of research on polarization effects in cadmium sulfide crystal counters are given. The kinematics of polarization effects and the dependence of the maximum value of the polarization potential on the working potential were studied. It was shown that in some scintillators the maximum polarization potential is below that of the working potential. The influence of infrared light on the polarization effect was also ascertained and investigated. To eliminate the influence of polarization effects, it is proposed to use a high-frequency potential instead of a constant one. The counting efficiency was compared for different crystals using constant and high-frequency potentials. Even crystals which apparently do not polarize for a constant potential were shown to have a higher counting efficiency when they are used with a high-frequency potential. Some work was done on the relation between pulse amplitude, α-particle energy, and working potential. The mechanism of pulse formation in cadmium sulfide crystal counters was also studied. With a view to the practical applications of cadmium sulfide crystal counters, measurements were made to determine their useful life and their counting efficiency for different parts of a given crystal. Practical methods were worked out for using them as α-particle counters and in certain other types of apparatus. (auth)

20743 BEHAVIOUR OF SEMICONDUCTOR NUCLEAR-PARTICLE DETECTORS. F. J. Walter, J. W. T. Dabbs, and L. D. Roberts (Oak Ridge National Lab., Tenn.). p.391-401 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In English)

Experimental and theoretical studies of the behavior of

semiconductor nuclear-particle detectors have been carried out over the temperature range of 0.2 to 300°K. A simple theoretical model for the detector behavior, which is found to describe the observed behavior over a wide range of parameters, is presented. The importance of semiconductor purity and bias voltage in connection with pulse height, pulse rise-time, and detector area is discussed. Empirical studies of noise and energy resolution indicate that for alpha particles the smallest observed peak-widths are substantially larger than those expected on the basis of electrical noise from the detector and amplifier. Equivalent noise values of ≤3 kev full-width at half maximum have been found for a 40-mm^2 silicon surface-barrier detector at 77°K. Semiconductor detectors exhibit a "pulse-height defect" for fission fragments. There is evidence that this defect is not caused by a "dead layer." If electric fields which are insufficient to insure complete "collection" are responsible for the defect, the necessary minimum field (at the surface) is $>3 \times 10^4$ v/cm for fission fragments, as compared to the value of 2×10^3 v/cm which is found necessary in the case of alpha particles in Ge and Si. Detailed considerations regarding pulse rise-time at the amplifier have shown that in high-resistivity material both the "dielectric" relaxation time and the resistance associated with the undepleted base material can play an important role. A quantitative description of the effect of detector and amplifier parameters on the shapes and rise-times associated with the pulse is presented. The advantages and problems associated with the use of surface-barrier detectors in several unique low-temperature nuclear-alignment experiments are discussed. These experiments involved fission-fragment angular distributions and resolution of alpha-fine structure with long-term stability. Matched expansion-coefficient fabrication techniques which have been successfully used to make detectors up to 8 cm^2 in active area are also described. (auth)

20744 SURFACE-BARRIER COUNTERS FOR NUCLEAR REACTION STUDIES. M. L. Halbert (Oak Ridge National Lab., Tenn.). p.403-13 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In English)

Silicon surface-barrier counters have been in routine use at Oak Ridge National Laboratory since October 1959 for spectroscopy of alpha particles and heavier ions emitted from nuclear reactions. Applications in recent experiments, including two (dE/dx,E) particle identification systems, are described. The counters were made from n-type silicon with a thin layer of gold deposited by vacuum evaporation. The pulse-height response to N^{14} ions up to 26 Mev was shown to be linear within ½%; also, the responses were identical for all particles tested, including protons, deuterons, alphas, boron, carbon, nitrogen, oxygen, and magnesium ions. No pulse-height defect was observed. Counters with shallow barriers were used successfully for study of scattering and transfer reactions of heavy ions. To stop high-energy alpha particles, several counters with the highest available resistivity (1500 to 2300 Ω-cm) were biased at 500 v; the barrier thicknesses were as large as 0.6 mm. The barrier depth in several counters was measured by two methods and found to be proportional to the square root of the bias from 0.005 to 0.6 mm. Evaporation spectra of 5- to 35-Mev alpha particles were studied. The proton contamination, which was present up to 9 Mev at full bias, was eliminated by reducing the bias, thereby decreasing the maximum energy a proton could lose in the sensitive region. In a 1500 Ω-cm counter exposed to 4-Mev N^{14} ions, slight increases in reverse current and noise level were noted after an accumulated dose of ~10^9 ions/cm^2. After 10^9 or 10^{10} ions/cm^2 the increased noise level rendered the counter useless. Several thin (0.08 to 0.2 mm) silicon wafers were successfully operated as dE/dx counters in conjunction with a thick scintillation counter. This new system provides a cleaner separation of protons, deuterons, and tritons than was obtained in the previous system with a gas proportional counter. It is also more stable, more convenient, and more tolerant of high counting rates. A (dE/dx,E) telescope was constructed for short-range heavy ions; here the dE/dx detector was a thin gas counter. To minimize energy losses, the silicon E counter was placed, in effect, inside the gas volume. In preliminary tests, C^{12} was bombarded with 28-Mev N^{14}, and C, N, Na, Mg, and Al ions emitted from the target were successfully separated. (auth)

20745 A SILICON SURFACE-BARRIER FAST-NEUTRON SPECTROMETER. T. A. Love, R. B. Murray, J. J. Manning, and H. A. Todd (Oak Ridge National Lab., Tenn.). p.415-26 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In English)

A new type neutron spectrometer has been constructed by depositing a thin layer of Li^6F between two silicon surface-barrier counters. The small size and low mass (approximately 10 g total), the relative insensitivity to gamma rays, and the simplicity of construction and operation are the principal advantages of the device. Neutrons are detected by simultaneously observing the alpha particle and triton from the $Li^6(n,\alpha)T$ reaction. The sum of the energies of these two particles is proportional to the energy of the incoming neutron plus the 4.78 Mev Q of the reaction. Pulses from the two counters are added and the sum pulse which should be proportional to the total energy absorbed by both counters is amplified and stored. The experiments described demonstrate that the pulse height is indeed a linear function of the neutron energy. Pulse-height spectra from slow neutrons and from monoenergetic neutrons in the energy region, 0.6 to 15 Mev have been recorded from several counters of this type using sensitive areas of 0.7 cm^2 with a Li^6F layer about 150 μg/cm^2 thick. In further performance tests the groups of mono-energetic neutrons from the $Be^9(\alpha,n)C^{12}$, $Be^9(d,n)B^{10}$, and $C^{12}(d,n)N^{13}$ reactions were largely resolved. The resolution is limited by charged-particle energy losses in the LiF layer, giving a full width at half maximum of about 300 kev for the fast neutron peaks, approximately independent of neutron energy. Coincidence circuitry was used to eliminate the background from gamma rays and to considerably reduce the serious background for the silicon (n, charged particle) reactions. However, even with the coincidence circuitry this background reduces the fraction of the pulse-height spectrum which appears in the peak from 90% for 5-Mev neutrons to 1% for 8 Mev and to 0.1% for 15 Mev. The present counters have an efficiency (limited by the thickness of the 150 μg/cm^2 Li^6F layer) of 3×10^{-3} for thermal neutrons and ~10^{-4} for 2-Mev neutrons. (auth)

20746 SEMICONDUCTOR DETECTOR SYSTEMS (dE/dx AND E) FOR THE DETECTION AND MASS IDENTIFICATION OF PROTONS, DEUTERONS, TRITONS, He^3 AND ALPHA PARTICLES IN THE 10 TO 30-Mev ENERGY REGION. H. E. Wegner (Los Alamos Scientific Lab., N. Mex.). p.427-45 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In English)

In the 10- to 30-Mev region of energy many different reactions can occur in a charged-particle scattering experiment and, without proper mass identification, complex spectra from different reactions are superimposed and in many cases impossible to analyze. A semiconductor detector system for the detection and mass separation of He^3 and alpha particles was described recently by the author. Briefly, a dE/dx p-n junction detector was constructed of a thin wafer of 6000-Ωcm p-type silicon, 0.002 in. thick, with a useful area of ~70 mm^2. The E detector employed in this study was a 1-cm^2 silicon p-n junction. This semiconductor detector system could separate alpha from He^3 particles with intensity ratios as high as 100:1 to 1000:1 over a 10- to 25-Mev range of energies. Comparisons between the semiconductor and gas ion chamber dE/dx detectors showed that the energy resolution of the semiconductor detector was improved over the gas ion chamber in accord with the ionization efficiency of the stopping media. This system has been redesigned into a compact package more practical for experimental applications. The advantages and details of this new design are discussed. The general method has been extended to protons, deuterons, and tritons with the use of semiconductor detectors for E and gas ion chambers for dE/dx. Protons, deuterons, and tritons from reactions induced in Be^9 by 28-Mev alpha particles have been analyzed with these systems and mass-separated spectra of each of the above particles are shown. Although many of the particles were energetic enough to penetrate completely through the E detector (i.e., >10-Mev protons), the system was still able to separate the three masses effectively. An experimental lithium-diffused p-n junction with a ~2-mm thick space-charge region detected 15-Mev protons, 17-Mev deuterons, and 15-Mev tritons with ~1% energy resolution and excellent mass separation. The advantages of these systems when applied to low-energy nuclear physics, such as increased resolution, improved mass identification, fast rise-time, and small size, are discussed and demonstrated by comparison with NaI scintillation systems. (auth)

20747 SOLID-STATE DETECTORS FOR MEASUREMENT OF dE/dx AND TOTAL ENERGY IN NUCLEAR REACTIONS AT CYCLOTRON ENERGIES. T. H. Braid and J. T. Heinrich (Argonne National Lab., Ill.). p.447-9 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In English)

Surface-barrier p-n detectors with thick sensitive regions for measuring the total energy of the reactions initiated by the Argonne 60-in. cyclotron and physically thin detectors to identify the nature of particles by their rate of energy loss were developed. The main design elements of these detectors and the principal performance data of the solid-state counter systems used are described. Detectors of 1 cm^2 sensitive area (0.5 μa leakage current at 400-v back bias in a typical case) are also described. The very satisfactory resolution of the Argonne detectors allows accurate measurements to be made in nuclear reactions at cyclotron energy. (auth)

20748 PROPERTIES OF SILICON n-i-p JUNCTIONS—APPLICATION TO THE DETECTION OF RELATIVISTIC PARTICLES. L. Koch, J. Messier, and J. Valin (Centre d'Études Nucléaires, Saclay, France). p.465-75 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In French)

An account is given of experience gained at the CENS on the detection of nuclear particles by semiconductors. One type of detector, of pin structure, has been specially studied. In comparison with the usual p-n or npp^+ structures, and given an equal purity of the base material, it has the advantage of permitting a larger effective volume for the following reasons: (a) with an equal potential difference applied to the crystal, the total thickness of the barrier layers is greater; (b) with an equal reverse current, the maximum potential difference which they can withstand is greater; (c) other things being equal, their capacitance per unit of area is smaller and hence the permitted maximum surface is greater. A detailed description is given of methods of obtaining pin structures in silicon, the intermediate zone reaching 1 mm. Lastly, certain applications of these detectors are described: α and γ spectroscopy and the measurement of dE/dX for relativistic particles. (auth)

20749 PRELIMINARY EXPERIMENTS WITH A SOLID-STATE IONIZATION CHAMBER. R. J. Griffiths (National Inst. for Research and Nuclear Science, Harwell, Berks, Eng.), C. J. Batty, P. E. Gibbons, and D. C. Northrop. p.497-500 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In English)

A solid-state ionization chamber has been made by diffusing phosphorus into high-resistivity silicon to form ohmic contacts. Such a detector has been successfully used to detect 30-Mev protons. Preliminary results are given and discussed. (auth)

20750 PROPERTIES OF SOLID-STATE DETECTORS. I. Dunmur, G. George, E. M. Gunnersen, and A. Hitchcock (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). p.501-9 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In English)

Conventional surface-barrier counters have been made from high-resistivity n-type silicon, and these have been capable of resolutions of 0.4% ± 0.1% (electronics plus counter contributions) at room temperature with 5-Mev alpha particles. Results are presented on the performance of these counters with alpha particles (5 Mev), soft x-rays, and 60 to 1200 kev electrons from a beta spectrometer. Parameters relating to counter performance, such as dead layer, linearity, resolution, noise, and depletion-layer thickness, constitute the bulk of the results. Experience with a process (which was originally described by the Service Electronics Research Laboratory (SERL), Baldock) for making junctionless conductivity counters from high-resistivity p-type silicon is discussed, together with considerations of the relative importance of various semiconductor properties in this application. Some preliminary tests on the performance of these counters, especially in relation to their potential as spectrometers for energetic gamma rays, are included. (auth)

20751 CHANGES OF I-V CHARACTERISTICS OF SiC DIODES UPON REACTOR IRRADIATION. M. Heerschap and R. De Coninck (SCK-CEN, Mol, Belg.). p.513-21 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In English)

In a search for semiconductors which can be used in high-flux reactors in order to measure flux distributions, SiC p-n junctions were irradiated in the Belgium BR-1 reactor. Two types of SiC diodes of different origin have been irradiated. These junctions are grown in the Lely furnace. The change in forward and reverse characteristics have been measured during and after irradiation up to temperatures of 150°C, while measurements up to a temperature of 500°C are in progress. It has been found that one type resists BR-1 neutrons up to an integrated flux of 10^{18} n/cm^2, while the other resists irradiation up

to a flux of 10^{17} n/cm^2. The changes in characteristics are given as well as the result of some annealing experiments. (auth)

20752 SEMICONDUCTOR COUNTERS AS CHARGED-PARTICLE AND NEUTRON SPECTROMETERS. G. Dearnaley, A. T. G. Ferguson, A. B. Whithead, and J. H. Montague (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.523-33 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In English)

Since December 1958, surface-barrier detectors in silicon and germanium have been studied at the Atomic Energy Research Establishment (AERE). A relatively simple and reliable technique has been developed for their construction, and results of their performance are shown. The best resolution obtained has been 15 kev and linearity has been achieved for protons up to 10 Mev, at which energy the resolution was 50 kev. The detector characteristics depend markedly upon the quality of the semiconductor starting-material. Not all counters attain the resolution figures quoted, due to recombination processes during collection of the carriers. A study of these processes is being made. The high resolution, excellent linearity, fast rise-time, compactness of size, and simplicity of design of these counters make them ideally suited for many applications in nuclear physics. One such application is the use of a detector as a proton-recoil neutron spectrometer, in which a thin hydrogenous radiator is deposited on the face of a counter. A neutron spectrum is obtained by differentiation of the recoil proton spectrum. Results with regard to resolution and efficiency of such a detector are presented. (auth)

20753 RECENT WORK ON INSTRUMENTATION FOR NUCLEAR PULSE-HEIGHT SPECTROSCOPY. B. Astroem, N. G. E. Johansson, and Gunilla Wickenberg (Nobel Inst. of Physics, Stockholm). p.535-41 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In English)

The invention of the semiconductor detector for charged nuclear particles has opened up new possibilities in the use of pulse-height spectroscopy techniques for studying nuclear reactions. The high intrinsic resolution of these detectors, both in time and energy measurements, has initiated some developmental work on the associated electronic circuits which are described. In the nuclear research work at the Nobel Institute a wide range of applications of semiconductor detectors is foreseen. The different experiments demand different types of detectors which generally have a limited life-time. In order to secure a sufficient supply of adequate units, the production of surface-barrier detectors has been started within the institute. A description of the detectors and the production techniques employed is given. (auth)

20754 THE USE OF SEMICONDUCTOR COUNTERS FOR MEASURING THE DISTRIBUTION OF PILE-NEUTRON FLUX. B. Lalović and V. Ajdačić (Boris Kidrić Inst., Vinča, Yugoslovia). p.543-8 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In English)

Semiconductor counters for the detection of fast and slow neutrons and their use for measuring neutron-flux distribution in the RA reactor in Vinča are described. (auth)

20755 SEMICONDUCTOR COUNTER AND ITS APPLICATIONS FOR NEUTRON MEASUREMENT. E. Sakai (Japan Atomic Energy Research Inst., Tokyo). p.551-65 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In English)

The performance of a silicon surface-barrier semiconductor counter and its applications for radiation detection, especially neutron measurements, are described. The counter has been constructed, using a 1000-Ω cm n-type silicon with a vacuum-evaporated gold film electrode, which showed an energy resolution less than 1% for 5.3-Mev alpha rays. The following are the main examples of its application: (1) Portable-pencil, transistorized radiation monitors with a small count-rate-indicating meter and crystal earphone have been made. (2) Alpha-ray spectrometers, which consist of a vacuum cell, low noise pre-amplifier, linear amplifier and a multi-channel pulse-height analyzer, have been made. In the vacuum cell are a rotating disk, on which six alpha-ray sources can be mounted and a NaI(Tl) scintillator for low-energy gamma-ray/alpha-ray coincidence measurements. (3) The precise spatial distribution of the JRR-1, a water-boiler type reactor, using the $B^{10}(n\alpha)$ and $Li^6(n\alpha)$ reactions was measured. Neutron-induced threshold reactions, such as $U^{238}(n,f)$ and $S^{32}(np)$ reaction, can be used for measuring the rough neutron energy distribution. A fast neutron spectrometer can be constructed either by the use of the $Li^6(n\alpha)T$ reaction or by the recoil proton energy measurement. By measuring $E_\alpha + E_T = E_n + Q$ in the $Li^6(n\alpha)T$ reaction, the value of E_n can be obtained. The actual method of the measurement, however, is by adding the two output pulse heights from a thin Li^6 foil or evaporated Li^6, the Li^6 foil or evaporated Li^6 being sandwiched between two semiconductor counters. The above recoil-proton energy measurement is for the proton energy, $E_p = E_n \cos^2\theta$, which is recoiled from a polyethylene radiator. (auth)

20756 ELECTRICAL LIMITATIONS TO ENERGY RESOLUTION IN SEMICONDUCTOR PARTICLE DETECTORS. W. L. Hansen and F. S. Goulding (Univ. of California, Berkeley). p.583-90 of "Nuclear Electronics. Vol. I." Vienna, International Atomic Energy Agency, 1962. (In English)

Based on the assumption that the noise contribution of a semiconductor detector is due solely to its bulk properties, equations are presented which indicate the theoretical limits of noise in detector-amplifier combinations. These equations show that an optimum amplifier time-constant and detector bias voltage exist for which condition the minimum noise is independent of the semiconductor resistivity. The optimum performance of a detector-amplifier system is shown to depend only upon detector area, input capacity (less detector capacity), semiconductor minority carrier lifetime, and the transconductance of the amplifier input tube. A new detector structure which includes a guard-ring electrode as an integral part of the detector structure is described which has the effect of largely eliminating noise due to surface leakage. Experimental results for detector leakage and energy resolution which agree well with theory are presented. The theoretical limit of noise, expressed as full width at half maximum, is from 7 to 10 kev for 1-cm^2 p-type silicon detectors at 25°C. (auth)

20757 NUCLEAR ELECTRONICS. VOL. II. Proceedings of the Conference on Nuclear Electronics Held at Belgrade, 15-20 May 1961. (International Atomic Energy Agency, Vienna). Proceedings Series. Apr. 1962. 468p. (STI/PUB/42(Vol.II)). $8.00 (IAEA).

Of the 50 papers published in this volume of the Proceedings, three were previously abstracted in Nuclear

Science Abstracts. The remaining 47 are abstracted separately. (L.T.W.)

20758 TRANSISTORIZED ANALOGUE-TO-DIGITAL CONVERTER FOR PULSE-HEIGHT ANALYSIS. A. F. Arbel (Ministry of Defense, Tel Aviv, Israel). p.3-9 of "Nuclear Electronics. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In English)

An analog-to digital converter was built employing a Miller run-down for the linear conversion of a pulse amplitude into time. The input is required in the form of current pulses from a suitable amplifier and delivered through a series gate to the low-impedance input of the converter. The converter consists of a current amplifier for charging the storage capacitor of a Miller time-base, with both the amplifier and the Miller time-base forming an integral part of the converter circuit. Voltage feedback from the output stabilizes the amplitude to which the capacitor is charged by incoming pulses. As each pulse passes its peak, the over-all feedback loop opens because the storage capacitor is charged through a diode, the latter being cut off during the run-down part of the cycle. However, the Miller part of the converter remains active and causes the storage capacitor to discharge linearly. With the completion of the run-down the over-all feedback loop closes again, returning the Miller capacitor to exactly the same quiescent voltage from which its charge had started previously. Thus, the influence of slow d-c drifts within the over-all feedback loop on the conversion factor is practically eliminated. A crystal oscillator assures the stability of the timing-clock pulses. Phasing problems are eliminated by delaying the start of the discharge until the arrival of a clock pulse. A description of the circuit and performance data are given. (auth)

20759 METHODS OF REDUCING ERRORS IN AMPLITUDE-TO-DIGITAL CONVERTERS. K. Kandiah (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.11-25 of "Nuclear Electronics. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In English)

Most pulse analyzers use the Wilkinson principle of amplitude-to-digital conversion because of its inherent simplicity. The various causes of inaccuracy in such converters and means of overcoming them are given. The principles of a new converter which uses largely semiconductor devices are given. The new converter possesses a high degree of channel-width uniformity and channel-position stability over a large dynamic range of pulse amplitudes. Methods of measuring converters to a high precision are also discussed. (auth)

20760 CHARGE-STORAGE TECHNIQUES FOR PULSE-HEIGHT ANALYSIS. L. Costrell and R. E. Brueckmann (National Bureau of Standards, Washington, D. C.). p. 29-39 of "Nuclear Electronics. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In English)

The low-duty cycles of many pulsed accelerators make high pulse rates necessary within the bursts in order to accumulate adequate data in a reasonable time. Not only do economic factors, as influenced by expensive machine time, dictate the use of high pulse rates, but purely technical considerations often make experiments unfeasible unless the pulses per burst are so numerous as to exclude the use of conventional pulse-height analyzers. For these reasons much effort has been devoted to the development of high-speed pulse-height analyzers for use with pulsed accelerators. Much of this work has been directed toward producing what is termed a "charge-storage analyzer" based on work conducted at the National Bureau of Standards. A charge-storage analyzer that operates with the NBS 180-Mev synchrotron on a nuclear-absorption experiment for which the obstacles would otherwise be formidable was developed. The analyzer uses temporary electrostatic storage for the accumulation of pulse-height data during the machine bursts. During the dead intervals between bursts the contents of the temporary storage are analyzed and transferred into a conventional magnetic core memory. The use of this technique for nanosecond pulses is discussed, and data are presented to show its feasibility. (auth)

20761 MULTI-CHANNEL RECORDING OF A PULSE SPECTRUM ON THE SCREEN OF A WILLIAMS TUBE USED WITH A FERRITE MEMORY ANALYSER. Shtirad Rumler (Inst. of Nuclear Research, Czechoslovak Academy of Sciences, Rzhezh). p.41-5 of "Nuclear Electronics. Vol. II." Vienna, International Atomic Energy Agency, 1952. (In Russian)

A block-diagram of program circuits with which it is possible to obtain a multi-channel trace of an expanded pulse-spectrum analysis on the screen of a Williams tube used in combination with a static ferrite memory is described. The conventional methods of direct recording on a Williams tube are in some cases unsatisfactory with the type of analyzer in question, the trace being insufficiently clear, especially for the analysis of intermittent pulse cascades with a low-repetition frequency and a small average number of pulses. This is because the information to be read is interpreted in the channel straight from the adding circuits and address circuits with direct recording on the screen. The direct recording is unsuitable owing to the small average number of pulses and the statistically intermittent distribution. In this regard, the method proposed is better. The quality of the recording depends neither on the shape of the spectrum nor on the pulse-counting rate. This method is used in a 256-channel analyzer with a ferrite memory of dead-time 15 μs. An oscillographic trace, with a period equal to that of the spectrum analysis cycle, is produced periodically at a frequency of 50 cycles per second. The period of the trace cycle is approximately 4 ms, i.e., 20% of the total duration of the working-cycle of the analyzer. In the case of analyzers with a smaller number of channels and with a memory of shorter dead-time, the time for the oscillographic recording is only a few percent of the duration of the working-cycle of the analyzer. (auth)

20762 A TRANSISTORIZED 1024-CHANNEL NEUTRON TIME-OF-FLIGHT ANALYSER. G. Giannelli (European Atomic Energy Community, Ispra, Italy). p.49-54 of "Nuclear Electronics. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In English)

A transistorized 1024-channel neutron time-of-flight analyzer is described. This instrument has been divided into two fully independent parts: the analog-to-digital converter (ADC) that measures the time-of-flight and the 1024-channel ferrite-core memory. In this way the output signals coming from the ADC can be recorded on a magnetic tape together with the output from other ADCs which measure other physical quantities related to the same nuclear event, with an over-all number of channels higher than the capacity of the memory. The AD converter is provided with a temporary memory that, by its regularizing action on the signal rate, (1) when the AD converter, directly connected to the 1024-channel memory, allows a dead-time of only 0.5 μs, and (2) when the AD converter drives a magnetic tape recorder and allows a better utilization of the magnetic tape itself. The temporary memory has a capacity of four numbers of up to sixteen

bits. The channel-width of the analyzer is variable from 0.5 up to 48 μs. The 1024 channels can be divided into two contemporary groups of 512, each connected to two detectors. The temporary memory allows contemporary recordings of signals into the two groups. The channels can also be subdivided over the time-of-flight in two groups of which the first (of 16 channels) is used to record the true zero time of the time-of-flight, while the second group can be set in any position over the total time-of-flight interval. The number of channels used in the recording of the time-of-flight can be reduced in order to record another quantity with 1024 over-all channels. The logical design of the instrument is described. In the design advantage has been taken of the possibilities offered by the transistorization and the related mechanical construction systems in order to produce a most flexible instrument and one in which future modifications or extensions, which may be required by the experimenters, are feasible. (auth)

20763 ADDRESS SCALER AND TEMPORARY MEMORY FOR A TRANSISTORIZED TIME-OF-FLIGHT ANALYZER. I. De Lotto (European Atomic Energy Community, Ispra, Italy). p.55-7 of "Nuclear Electronics. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In English)

Circuit design conditions and procedures for address scaler and temporary memory are analyzed. Methods for reducing the recovery time of the address scaler (which should be less than 10^{-7} s) and the writing time of the temporary memory (10^{-7} s) are briefly examined. The complete circuits and the experimental results are discussed. (auth)

20764 MULTI-MEASURING TAPE-RECORDING SYSTEMS WITH STATISTICAL EQUALIZING. G. P. Zhukov, G. I. Zabiyakin, et al. p.61-72 of "Nuclear Electronics. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In Russian)

One likely way of increasing the number of channels of multi-measuring recording systems is the multi-track recording on magnetic tape of information presented in binary form. A 25-track recording system is briefly described, and the fundamental technical characteristics and potentialities of such systems are indicated. A special feature of the recording system described is the use of an "equalizing unit," with which one can obtain a uniform tape recording of input pulses with a statistical time distribution. The main circuit of the equalizing system is given, and a means of determining its required capacity for a different spectrum shape described. The question of extracting data from multi-measuring systems is discussed. (auth)

20765 TWO-DIMENSIONAL SELECTOR TYPE 2X3. Y. Amram (Centre d'Études Nucléaires, Saclay, France). p.73-80 of "Nuclear Electronics. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In French)

This selector is intended for study of (n,γ) reactions and has 2^{16} channels (1024 time channels and 64 amplitude channels). The characteristics (arrival time and amplitude) of each significant event are recorded, after coding, on a sixteen-track magnetic tape. The examination of the information on the tape is carried out in sections on a results analysis unit consisting of a memory with 1024 channels which totals events having the same characteristics within an amplitude-time range set by the operator. The instrument has the following general characteristics: time selection, 1024 channels of width between 0.1 and 6.4 μs divided into eight zones of interest of 128 channels; amplitude selection, 64 channels 0.25 to 1 v wide; average dead time, 7 μs; resolution time of the complete apparatus is less than 20 μs; conditioning for reading: it is possible to read a spectrum of times of flight in an amplitude band contained within any two limits. A similar operation can be carried out simultaneously for four amplitude spectra. (auth)

20766 20 MHz TRANSISTORIZED CLOCK. B. Ollivier, R. Poussot, and J. Thénard (Centre d'Études Nucléaires, Saclay, France). p.81-4 of "Nuclear Electronics. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In French)

This clock, which is designed for a time of flight selector with 50-ns band width, has the same function as a triggered oscillator. The oscillator is fitted with a 40-MHz quartz to ensure high precision on the band width. This frequency is halved by means of a flip-flop. Through a phasing circuit the triggering pulse controls the opening of a gate with a phase suitable to pass the 20-MHz pulses thus obtained toward the outer circuits. In this way, the resulting series of pulses starts with an uncertainty of ± 12.5 ns with respect to the moment of triggering. The apparatus is made up of eleven transistors. (auth)

20767 BINARY NUMBER COMPARATOR. Y. Amram, H. Guillon, and J. Thénard (Centre d'Études Nucléaires, Saclay, France). p.85-90 of "Nuclear Electronics. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In French)

A comparator of numbers expressed in the natural binary system, working in parallel, has been produced. This makes it possible to ascertain whether an unknown number X is smaller or greater than a given number A; the case where X = A is not in evidence. The apparatus uses medium quality transistors and has a response time of the order of 1 μs. A combination of two comparators working together forms a "conditioner" which identifies the condition $A < X < B$. By making certain adjustments, the limits can be contained within the conditioning interval. (auth)

20768 INTERMEDIATE ARITHMETIC MEMORY. Y. Amram, H. Guillon, and D. Tandardini (Centre d'Études Nucléaires, Saclay, France). p.91-100 of "Nuclear Electronics. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In French)

This memory is designed to smooth the random flow of previously coded information, in preparation for recording on magnetic tape. It is made up of ten registers with 16 binary digits and two ten-position switches, one controlling writing and the other reading; auxiliary circuits ensure the correct position of each of the switches with respect to the other. As a result of the very small capacity and low persistence required, the memory elements selected are condensers insulated by silicon diodes. The main characteristics are as follows: access time less than 10 μs; output rate: 0.25, 0.5, 1 or 2 ms. Only the switch circuits are fitted with standard electronic tubes and trochotrons. The logical transistor circuits and the memory elements are mounted on printed cards 10 by 10cm. The instrument appears as a rack of five units, 50 cm deep. (auth)

20769 TIME CODING WITH A BINARY SCALER. J. Thénard (Centre d'Études Nucléaires, Saclay, France). p.101-8 of "Nuclear Electronics. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In French)

A binary scaler is normally used in time-of-flight selectors to code the arrival time of an event and to send it in the appropriate address of a memory. Such scalers involve special problems; two are examined in this paper: (a) The scaler periodically receives long series of impulses.

The constituent flip-flops, particularly the first, have to be specially designed for these working conditions, which appear rather more severe than those of the purely random or strictly periodic operations. (b) It is advantageous to catch, in flight, the coded number representing the arrival time of an event, and so avoid a momentary stop of the scaler and artificial restoration of the normal count afterwards. It can be caught in flight provided that the transit time in the scaler is less than the input pulse period. A scaler with a very short transit time has been developed, and then a scaler with simultaneously driven elements. The latter, designed to operate at 10 MHz, comprises ten flip-flops and reaches its stable state 5×10^{-9} s after the injection of each input pulse. (auth)

20770 LODESTAR: A NEW COUNTER DATA-HANDLING FACILITY. A. Roberts and C. Rockwood (Argonne National Lab., Ill.). p.111-19 of "Nuclear Electronics. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In English)

LODESTAR (Logically Organized Data Entry, Storage and Recording) is designed to analyze and store complex electronic-counter data from high-energy-pulsed accelerators. It receives digital and analog information at high speed during the short (1 to 200 ms) beam burst and digitizes and stores it in a core memory. Between machine pulses (2 to 4 s) the data are transferred to a magnetic tape. Analysis is by off-line general-purpose computer. In contrast to earlier systems, an event is not set up as a single word with parallel entry into the core memory. Instead, a fixed word length (say, 12 bits) is used, and a format control enters each event into the core memory as a serial group of words via a one-word register. A format character of six bits is used for each recorded event to indicate the number of words describing the event. Events of different complexity are readily accomodated up to the memory capacity of about 10^4 bits. Storage time is 4 μs per word. After each beam burst, additional coded data like serial number, beam energy, and magnet current are transferred to the tape via the one-word register, without entering the memory; an additional 6-bit format character describes these "slowly-varying" quantities. It is planned to include analog-to-digital converters, parity checking, tape verification, analog display of data, and cathode-ray tube memory display for system checking. External logical circuitry must be provided to select the desired events. (auth)

20771 DEVICES FOR PROCESSING DATA FROM MULTI-CHANNEL ANALYSERS. L. A. Matalina, S. I. Chubarev, and A. S. Tishechkina. p.121-5 of "Nuclear Electronics. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In Russian)

A SYSTEM FOR THE PRELIMINARY PROCESSING OF DATA FROM A NEUTRON SELECTOR. With this system data can be summed from a series of consecutive measurements, with and without a sample in the beam; the background can be isolated, and the shift of the sample and the statistical measuring error can be calculated. The system includes a magnetic-tape memory, a cipher arithmetic element with division, an analog cipher device for error calculation, and an electromechanical device for determining the background. All these cipher devices employ ferrite-transistor elements and the analog devices employ electronic tubes. The system is intended for work with a 1024-channel analyzer; the analyzer's printing device is used for data extraction. APPARATUS FOR PROCESSING DATA FROM A SCINTILLATION γ-SPECTROMETER. The apparatus is intended for processing gamma spectra by the matrix method. The possibility of using both a forward and a reverse matrix is envisaged. The apparatus works together with a 128-channel amplitude analyzer having a binary-decimal code memory system. The data in the memory of the analyzer can be stored in the measuring process or introduced manually. The conversion matrix is introduced by means of perforated tape. The whole converter circuit uses ferrite-transistor elements; the data are taken from the apparatus on the analyzer's printer. The equipment can also be used for processing neutron spectra. (auth)

20772 HODOSCOPE PERFORMANCE AND DESIGN. A. Boyarski and D. Ritson (Massachusetts Inst. of Tech., Cambridge). p.143-6 of "Nuclear Electronics. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In English)

The performance and circuitry of a hodoscoped array of 200 counters used on an experiment at Brookhaven are described. The circuitry, transistors, and phototubes all showed remarkable long-term stability. The lifetime of the transistors was 0.5×10^8 h, and only one out of the 200 phototubes deteriorated after six months use. A simple set of diagnostic routines checked performance of the apparatus in half an hour. The data were recorded on film, and the film was read with a "programmed spot" scanner into the M.I.T. TXO computer. One hour is required to read a 400-ft roll of film by this system. A simple modification has been made to the apparatus whereby the data are stored in parallel into a shift register and then read out serially onto magnetic tape. Such a system writes a 300-bit event on to tape in 1 ms and obviates the necessity for buffer storage. (auth)

20773 AN AUTOMATIC ELECTRONIC SWITCH. H. Guillon (Centre d'Études Nucléaires, Saclay, France). p.147-54 of "Nuclear Electronics. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In French)

An electronic switch which, on the order of a single pulse, successively selects a given number of channels is described. The switching time for all channels may be the same, or may vary according to channel; one or more positions may be maintained by external control for an indefinite length of time. This circuit is very flexible in programming; it can if necessary act as a counter and as a pulse generator. It is convenient to limit the number of switched channels to ten, but this can be greatly increased by a general extension of the system. Applications of an apparatus for transferring the contents of decimal scalers to a printing machine are described; this machine employs the sequential series method and with a binary-decimal scale converter which operates by summing the weights of the different binary digits. (auth)

20774 MULTI-DIMENSIONAL SELECTORS WITH MAGNETIC MEMORY. J. M. Tissier. p.155-66 of "Nuclear Electronics. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In French)

The Société Intertechnique, in collaboration with the Commissariat à l'energie atomique, has studied different standard memory units having 1024 and 4096 channels. These information storage units can be included as a memory element in a measurement chain or, with certain accessories, can serve as complete multi-dimensional selectors. The 1024-channel unit, which was designed more especially for the read-back of information stored on a multi-track magnetic tape, has been generally enlarged and expanded into a 4096-channel selector. This type of memory unit, coupled to a 128 or 256 channel digital analog converter for example, becomes a selector with 32×128 or 16×256 channels which can be used to study the spectrum

of a nuclear reaction involving 16 or 32 parameters. These instruments have been specially designed to embody the following features: easy maintenance (printed panels mounted on movable chassis), size and shape resembling those of an oscillograph, versatility (numerous accessories and various modes of operation). (auth)

20775 16-CHANNEL ANALYSER WITH HIGH TIME-RESOLUTION FOR MULTIPLE COINCIDENCE EXPERIMENTS. B. Brandt and U. Cappeller (Universität, Marburg, Ger.). p.167-71 of "Nuclear Electronics. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In English)

In usual slow-fast-coincidence experiments such events are counted which are selected in pulse-height by means of single-channel analyzers. It is desirable to extend these techniques to a simultaneous energy-analysis of the pulses, selecting pulse-heights by means of multi-channel analyzers. Multi-channel analyzers used to perform such multiple coincidence experiments should give information about the amplitudes of arriving pulses at a well defined time-interval after the rising of the analysed pulse. A 16-channel pulse-height analyzer is described which permits the generation of a pulse-height signal 2.5×10^{-6} s after pulse-rising with an uncertainty of less than $\pm 2 \times 10^{-8}$ s. The resolving-time is less than 5×10^{-6} s, controlled by an inspector-circuit to avoid distortions arising from the pile-up of pulses. The channel width is controlled by a window-amplifier, adjustable from 1 v to 7 v. The channel-height may be selected from 7 v to 103 v in steps of 0.5 v. (auth)

20776 A 900-CHANNEL COINCIDENCE PULSE-AMPLITUDE ANALYSER. T. K. Alexander and L. B. Robinson (Atomic Energy of Canada Ltd., Chalk River, Ont.). p.173-83 of "Nuclear Electronics. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In English)

An analyzer designed for correlation studies of pulse-height distributions from two scintillation counters is described. The analyzer consists of two separate transistorized units; a dual-channel analog-to-digital encoder and a 900-channel, 2^{16}-per-channel capacity ferrite-core store. The display and control unit for the instrument is separate and can be situated away from the analyzer. The analysis mode of operation for coincident pulses on the A and B inputs of the encoder can be selected to be 30 by 30, 100 by 9, or 300 channels by 3 distributions. In the last two modes the base lines and the widths of the pulse-amplitude "windows" on distribution A can be selected by the operator. With 100 channels for pulse-amplitude analysis, eight "windows" in distribution A define eight groups of 100 channels for the B distributions. In this case one has, in effect, one 100-channel analyzer for distribution A and eight separate 100-channel analyzers to which B can be routed. A description of the basic circuits of the encoder and the logic of the store and display units is given. (auth)

20777 PROBLEMS RAISED BY PULSE ANALYSERS—FUNCTIONAL MULTI-DIMENSIONAL ANALYSERS. A. Pagès (Centre d'Études Nucléaires, Saclay, France). p.185-95 of "Nuclear Electronics. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In French)

Experimenters are making increasingly frequent use of analysis units by which a function of several parameters can be obtained (the number of parameters and the relative precision of each of them being variable from experiment to experiment). Present-day analyzers are poorly suited to the steadily growing complexity of experiments. There are several reasons for this: the number of possible parameters is far too small (unblocking only on 100-channel and 256-channel analyzers) as is also their capacity; this limitation considerably increases the accelerator time; sometimes the poor "yield" of these analyzers makes the experiment impossible; moreover, being designed in a single "block," they are lacking in flexibility for use. A multi-dimensional apparatus limited to 2 paths of 63 channels was studied and built. The various essential functions are separated: analysis, transfer (multi-dimensional operation), utilization of results. A multi-dimensional analyzer, 1023 channels by 63 channels, is being designed and built. A functional multi-dimensional analyzer, in which the transfer function itself has been broken down into units (interrupter, non-integrator memory, conditioner and computer), is also being developed. Like the limits defining the paths, the types of units selected vary in accordance with the requirements and complexity of the experiment (standard inter-functional language). (auth)

20778 AN AUTOMATIC DATA-TAKING SYSTEM. R. H. Deinert and L. A. Ch. Koerts (Inst. for Nuclear Physics Research, Amsterdam). p.197-204 of "Nuclear Electronics. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In English)

A system has been constructed which makes it possible to do a series of measurements with the automatic use of a pulse-height analyzer. Each of these measurements includes pulse-height analysis, recording of the experimental data, and variation of parameters. The sequence of measurements is controlled by a prefixed and interchangeable program. The program is determined by the choice of connections on a removable patchboard. The system consists of a modified RCL-256-channel pulse-height analyzer, ten fast binary scalers for the storage of parameters values, a punch-tape output including a parity check for all data, and a control unit which can be programmed. (auth)

20779 A 1024-CHANNEL MAGNETIC-DRUM TIME ANALYSER. I. A. Radkevich, V. V. Sokolovskii, et al. p.205-13 of "Nuclear Electronics. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In Russian)

A 1024-channel time analyzer with channel widths 0.2, 0.4, 0.8, and 1.6 μs ($\pm$ 0.1 μs) has been designed and built for work with a mechanical neutron chopper. Choice of the smallest channel width, 0.2 μs, was determined by the minimum duration of neutron pulses obtained with the mechanical chopper. A magnetic-drum memory system with a fast electrostatic temporary memory was employed. The data on the magnetic drum are recorded on an automatic register and on standard punched cards, which enable it to be handled in any computer. (auth)

20780 MULTICHANNEL TIME-ANALYSER WITH AN ELECTROSTATIC MEMORY TUBE. K. G. Ignat'ev, I. V. Kirpichnikov, and S. I. Sukoruchkin. p.215-19 of "Nuclear Electronics. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In Russian)

Two multichannel time analyzers with an LN-4 electrostatic memory tube for pulse analysis were built. These analyzers are at present being used for various kinds of measurements; they have the following characteristics: number of channels, 1024 and 2048; channel time width from 0.2 μs upwards; channel capacity, 4096 pulses and 1024 pulses; analyzer trigger frequency, up to 1000 per second; and pulse load, up to 1000 pulses per second. Measurement results are given by the analyzers in the form of graphs and numerical data on perforated cards. (auth)

20781 A 256-CHANNEL MEASURING AND RECORDING SYSTEM. I. S. Krasheninnikov, S. S. Kurochkin, et al. p.221-35 of "Nuclear Electronics. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In Russian)

A system of measuring and recording units intended for use in a wide range of physical experiments is described. The basis of the system is a 256-channel register unit with a channel capacity of 2^{16} and a control unit. The system is executed on ferrite cores and transistors. The arithmetic element of the register unit makes it possible to perform adding and subtracting operations. The time of a complete cycle up to the memory is 20 μs. In the control unit, the basic controls, such as the settings for registering, counting and recording, can be combined in any order, which gives a much wider range of application as compared with normal equipment. The frequency of the control unit is taken from a 4-Mc/s quartz generator. As measuring units the system employs a pulse-amplitude-to-cipher code converter with a conversion time of 0.25 μs per channel, integral nonlinearity better than 0.1%, differential nonlinearity less than 4%, zero drift less than 0.2 v, and channel-width instability less than 0.4%, for lengthy periods. The converter system employs tubes. The time selector, which employs transistors, has a channel width from 1 to 64 μs; the channel-width instability is less than 10^{-4}. The logic of the circuit is such as to permit registration of incomplete pulses into the channel for channel widths of more than 8 μs. The unit used to convert small time-intervals (10^{-9} to 10^{-7} s) into a unitary cipher code has a time resolution of about 2×10^{-8} s and a channel width stability better than 10^{-2}. From the memory unit the information can be passed either in an analog form to an oscillograph tube or in the form of cipher code to a printer and indicator lamps. (auth)

20782 A HIGHLY STABLE PULSE-HEIGHT DISCRIMINATOR. K. Kandiah (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.239-51 of "Nuclear Electronics. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In English)

Direct-coupled trigger circuits require pulses of large amplitude when used for accurate pulse-height discrimination. Sensitive pulse-height discriminators using the incremental characteristics of diodes have been described in the literature. These use a-c coupling round the feedback loop and suffer from the disadvantage of having the threshold dependent on input pulse shape. A new trigger circuit using transistors and semiconductor diodes which can be used as a pulse-height discriminator of high accuracy for current pulses is described. This trigger circuit has the advantages of high sensitivity and independence of pulse shape over a wide range. (auth)

20783 EQUIPMENT FOR MEASURING THE LINEARITY AND LONG-TERM STABILITY OF PULSE AMPLIFIER GAIN. Ya. Viekha. p.261-4 of "Nuclear Electronics. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In Russian)

A simplified method has been used for measuring the linearity and stability of pulse-amplifier gain to an accuracy greater than +0.02%. The simplification was based on the use of a single relay switch and a common comparator-channel without the two-pulse voltmeters. The relay, operating with a 0.5 to 1-s period, sends the output pulses from the test amplifier and the calibrated pulses from the pulse-generator to the comparator consisting of a discriminator, an expander amplifier, and an indicator. The pulse-repetition frequency can be 1000 cycles per second or more. In this simplified method, the comparison is not between single pulses but between groups of these pulses corresponding to intervals of 0.5 to 1 s. As indicated at the output of the comparator, a pulse-recording voltmeter or a synchronoscope may be used. (auth)

20784 A NEW LINEAR METHOD OF DISCRIMINATION BETWEEN ELEMENTARY PARTICLES IN SCINTILLATION COUNTERS. E. Gatti and F. de Martini (Politecnico and Istituto Nazionale di Fisica Nucleare, Milan). p.265-76 of "Nuclear Electronics. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In English)

The general problem of different shape-signal discrimination by means of linear networks is illustrated, and a theory is developed to synthesize an "optimum" linear filter in order to discriminate between different specific ionizing power, low energy, and elementary particles detected by a scintillation counter. An electronic circuit embodying such an "optimum" linear filter design is illustrated and experimental results of discrimination between Po^{210} rays and Cs^{137} rays (Compton electrons), detected by an anthracene scintillation counter, are shown. The experimental resolution power (minimum energy of discrimination) is compared to that theoretically evaluated for the "optimum" filter (10 kev for electrons). (auth)

20785 ELECTRONIC METHODS FOR DISCRIMINATING SCINTILLATION SHAPES. M. Forte, A. Konsta, and C. Maranzana (European Atomic Energy Community, Ispra, Italy). p.277-86 of "Nuclear Electronics. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In English)

The scintillation pulse shape, which is characteristic of the excitating particle type (electron, proton, alpha, etc.), can be converted into a pulse-height independent parameter. This displays, by means of a multichannel analyzer, the composition of a mixed particle beam which excites the scintillator. This method was successful with several scintillators, both of the organic and the inorganic type. Details are given of the electronic techniques used for converting the pulse shapes. For the simpler case of discrimination between only two classes of pulses (e.g., neutron-gamma discrimination) the use of passive networks has also been considered possible for further improvements and simplifications. A few networks were tried, the main results being that, in the presence of gamma background, the discrimination of recoil protons in liquid scintillators was extended to small pulses of a few decades of photoelectrons and the discrimination of neutron-capture fragments in boron-loaded liquids was obtained. Some of these networks operated with pulses of the same polarity, from two of the last dynode, or even with the output from a single electrode. This may be useful when it is convenient to use the anode independently, e.g., for operating fast time circuits. (auth)

20786 NEW APPARATUS FOR DISCRIMINATING SHAPES—APPLICATION TO THE STUDY OF NEUTRON-PROTON ELASTIC SCATTERING AT 14.6 Mev. J. P. Crettez, F. Cambou, and G. Ambrosino (Laboratoire Maurice de Broglie, Paris). p.287-95 of "Nuclear Electronics. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In French)

The mean life of scintillations in cesium iodide is dependent on the nature of the ionizing particle, the shortest life corresponding to the highest ionization density. This property is utilized for distinguishing different particles producing scintillations of similar amplitude. The apparatus described is a shape discriminator. It measures the time required by the scintillation to fall from its maximum to an adjustable fraction thereof. A time-amplitude converter provides a pulse the height of which is proportional to the time so measured. A comparison is then made between the shapes of the scintillations produced by alpha particles, protons, and electrons, and the results obtained are shown. Application of this method to the measurement

of recoil protons set in motion in a thin hydrogenated diffuser by a neutron flux is also described. Suppression of the pulses produced by gamma rays makes it possible to deduce from the spectra obtained the variation of the differential elastic scattering cross section in terms of the angle for d-t reaction neutrons. (auth)

20787 A NEUTRON SCINTILLATION COUNTER WITH LOW SENSITIVITY FOR γ RAYS. V. G. Brovchenko and G. V. Gorlov (Kurchatov Inst. of Atomic Energy, Academy of Sciences, USSR). p.297-303 of "Nuclear Electronics. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In Russian)

A simple scintillation counter circuit with a high efficiency for recording neutrons and a low efficiency for gamma rays is described. The operation of the counter is based on the different shape of the scintillation pulses produced in stilbene by neutrons and gamma quanta. Separation is obtained over a wide range of neutron energies. The minimum energy for which neutrons can be distinguished from the gamma background is 80 kev. In neutron recording the amplitude characteristic of the output pulses is approximately linear. The question of the degree to which counts due to the gamma background can be eliminated is also discussed. (auth)

20788 PULSE-FORM DISCRIMINATION IN ORGANIC SCINTILLATION CRYSTALS. L. J. de Vries and F. Udo (Instituut voor Kernphysisch Onderzoek, Amsterdam). p.305-13 of "Nuclear Electronics. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In English)

A proton-electron discrimination circuit, based on the pulse-form differences between proton and electron-induced scintillation light pulses in stilbene is described. The circuit is stable and resolves proton from electron pulses down to a proton energy of 300 kev. The discrimination circuit, which contains only linear elements, is sensitive to pile-up-induced errors for only 0.1 μs after the arrival of a pulse. The described circuit has now been used in a 1 to 30 Mev neutron spectrometer based on proton-recoil between two stilbene crystals. A resolution of 10% at 14 Mev neutron energy was obtained with a detection efficiency of 1.3×10^{-4}. A neutron monitor, also based on linear pulse-form discrimination, could be used to measure a neutron dose of 10% of the maximum permissible dose in the presence of a gamma flux of 4 times the maximum permissible dose. (auth)

20789 THE USE OF PULSE TRANSFORMERS WITH RADIATION DETECTORS. F. C. Loveless and J. Grossart (20th Century Electronics Ltd., New Addington, [Eng.]). p.317-27 of "Nuclear Electronics. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In English)

It is frequently necessary to site the radiation detector and its associated indication instrument at some distance from each other and this involves the transmitting of pulse signals through long lengths of cable. The use of pulse transformers is one solution to this problem and the characteristics of various pulse-transformer detector systems for proportional counters and fission chambers are discussed in detail, together with their operating characteristics. (auth)

20790 SINGLE-CHANNEL TRANSISTORIZED SELECTOR. H. Andrieux, J. Guitton, and L. Hugolin (Centre d'Études Nucléaires, Saclay, France). p.329-36 of "Nuclear Electronics. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In French)

The special aim has been stability of the thresholds and standardized pulses under variations of temperature, and also interchangeability of transistors. The selector has the following specifications: input dynamic, 100 mv to 10 v; adjustable channel width, 100 mv to 1 v; minimum resolving time, 5 μs; maximum storage of capacitor, 100000 cps; linearity of capacitor, $\pm 1\%$; stability of capacitor: final information is retained to 1% after 24 hours. Tests of the selector under variations of temperature were carried out between $-20°$ and $+55°$. The following was observed: threshold variation of $+2\%$ for a threshold of 100 mv; channel-width variation of $\pm 2\%$ for a width of 100 mv; stored information variation in the capacitor of $\pm 2\%$. The selector is wired on a plate of dimensions 196×96 mm. Consumption is 20 ma at -18 v and 30 ma at $+18$ v. (auth)

20791 A LINEAR CIRCUIT FOR MEASURING THE AMPLITUDE RATIO OF TWO PULSES. R. Bayer (Inst. of Nuclear Research, Warsaw). p.337-44 of "Nuclear Electronics. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In English)

A circuit which changes linearly the amplitude ratio of two simultaneous pulses is described. Up to now circuits have logarithmic characteristics. Their principal work is to charge capacitors to voltages which are equal to the amplitude of pulses and then discharge them through the RC circuit of the same time constant. This system has disadvantages owing to logarithmic characteristics and because one cannot distinguish the ratio from its reciprocal. The circuit described has not this disadvantage. Its working principle is based on the use of the Miller principle in a pentode tube. This circuit was applied, up to now, to the linear change into time of the pulse amplitude which is applied to the plate. Such a circuit type was used in amplitude analyzers. If one considers some steady parameters in this circuit it is found that the sweep time is inversely proportional to the first grid voltage. Thus, if an amplitude of the second pulse is applied to the first grid there appears, at the second grid of the tube, a linear dependence of the pulse width to the ratio of pulses. (auth)

20792 NEW METHODS FOR CONTINUOUSLY CORRECTING COUNTING LOSSES DUE TO THE DEAD TIME OF THE DETECTORS AND THEIR ASSOCIATED CIRCUITRY. J. J. Point and A. Blave (Institut Interuniversitaire des Sciences Nucléaires, Mons, Belg.). p.345-60 of "Nuclear Electronics. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In French)

After referring to the shortcomings of present correction techniques the authors propose new electronic methods of exact, automatic, and continuous correction for dead-time losses. In the various designs proposed a first conditional circuit stops the passage of pulses to the counter if any part of the apparatus is cut off for any fraction, say x%, of the time. Additional pulses, equal in number to the pulses lost, are injected into the counter. In one design these pulses are obtained by sending pulses via a second conditional circuit to a point on the counter circuit. This design is applied, for example, to the G.M. detector. The steps necessary to avoid coincidences are described. In another design, the second conditional circuit is open during a fraction $x/(100 - x)$ of the time and the frequency is proportional to that of the pulses entering directly into the scaler; this design is especially suitable in the case of a multiple-channel magnetic analyzer. The time is then divided into short intervals and the correction is made at the end of each time interval. In both designs, the correction mechanism is simple; its addition requires no modification of existing equipment. Even if the counting rate varies rapidly with time, correction is accurate and quasi-continuous. Moreover, the true time is kept. (auth)

20793 THE DETERMINATION OF RANDOM EVENT-RATE BASED ON COUNTER LIVE-TIME MEASUREMENT.

V. Radeka (Institut Rudjer Bošković, Zagreb). p.361-7 of "Nuclear Electronics. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In English)

The method of determining the true rate of events generated by a random process based on a counting device and live-time measurement is analyzed. The determined rate is basically independent of the counter-resolving time. It is shown that the error caused by the resolving time of an event-to-pulse converter at the input of the system is substantially lower than the actual reduction of the rate by the converter itself. Live-time measurement error is discussed with respect to the application limit of the method. The analysis given may be applied to pulse-height analyzers and counters using live-time measurement. The method can simply be realized in pulse-height analyzers and counters with electronic timers. (auth)

20794 A PULSE SCALER USING A NEW MULTI-STABLE SYSTEM. E. Dzhakov, A. Markov, et al. p.369-75 of "Nuclear Electronics. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In Russian)

A new scaler based on the use of a multi-stable system, in which the number of pulses entering the circuit is given by the position in time of a single internal pulse circulating periodically in the system is described. The new features in the proposed circuit are the method of determining the position of the periodic pulse with which the count is made and the self-synchronization of the internal pulses, which permits the use of pulse generators with fairly low periodic stability. The method by which the efficiency of the circuit is calculated and the results of experimental work are given. (auth)

20795 HIGH-VOLTAGE-POWERED TRANSISTORIZED PREAMPLIFIER. W. E. Wilson, Jr. and A. W. Wakefield (Univ. of Washington, Seattle). p.385-94 of "Nuclear Electronics. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In English)

One of the problems that is frequently met in the field of nuclear electronics is that of coupling the signal from a high-impedance pulse-type radiation detector to a low-impedance transmission line. Radiation detectors and their associated counting equipment are often separated by a considerable distance and some efficient means of transmitting the signal from the detector to the counting system must be provided. In practice, a low-impedance coaxial cable is used for the transmission line and a cathode-follower or emitter-follower circuit is used to achieve the required impedance match. A unique emitter-follower circuit that has been utilized very successfully is described. The emitter-follower circuit is unique in that power for the transistor circuit is derived from the high voltage that is supplied to the radiation detector. The two pnp alloy-junction transistors employed in the preamplifier yield a voltage gain of unity over a dynamic range of from 1 mv to 5 v. Stabilization of the operating voltage for the emitter-follower circuit is provided by a small zener diode. The current drain of a typical remote-scintillation detector employing the circuit ranges from 0.35 to 0.65 ma when the high voltage is supplied to the scintillation detector is varied from 800 to 1500 v. The unit will drive 500 ft of 52-Ω coaxial line with a 25% loss in pulse amplitude and has been used with remotely operated scintillation-type detectors and BF_3-type neutron detectors with excellent results. (auth)

20796 TRANSISTOR PRECISION PULSE-SHAPER WITH SHORT RECOVERY TIME. I. De Lotto (European Atomic Energy Community, Ispra Italy). p.395-8 of "Nuclear Electronics. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In English)

A pulse-shaper with a short recovery time is very often necessary in nuclear electronics. The pulse-shaper which has the lowest recovery time is the one-shot multivibrator with RC timing-network. This type of timing network and the influence of transistor characteristics on the performance of this circuit are analyzed. Some circuit modifications are suggested for obtaining (1) a pulse-width precision better than 2% without the need for individual adjustments and (2) a pulse-width stability better than 1% over a 20°C temperature range. The circuit is so designed that use is allowed of transistors with a low base-emitter inverse-voltage like that of most of the fastest types. (auth)

20797 10-MHz TRANSISTORIZED PULSE-HEIGHT DISCRIMINATOR. J. L. Lecomte and R. Allemand (Centre d'Études Nucléaires, Grenoble, France). p.399-404 of "Nuclear Electronics. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In French).

A transistorized pulse-height discriminator with a resolving time of 100 mμs is described. It is composed of a discriminator and a wave-shaping stage delivering standard negative pulses of 4 v and 60 ns. It covers a range of 0.5 v to 10 v for a pulse length of 40 ns. The triggering precision and the temperature and time drifts are approximately of 20 mv. (auth)

20798 PULSE-AMPLITUDE MULTIPLIERS USING LOGARITHMIC AMPLITUDE-TO-TIME CONVERSION. M. Konrad (Institut Rudjer Bošković, Zagreb). p.405-11 of "Nuclear Electronics. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In English)

The accuracy and limitations of multipliers based on logarithmic amplitude-to-time conversion using RC pulse stretchers are discussed with respect to their application for determining whether the amplitude product of two coincident pulses has a given value. Some possible circuits are given. (auth)

20799 A PARTICLE IDENTIFICATION SYSTEM. F. Udo, R. F. Rumphorst, and L. A. Ch. Koerts (Instituut voor Kernphysisch Onderzoek, Amsterdam). p.413-20 of "Nuclear Electronics. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In English)

Particles of different charge Z and mass M resulting from a nuclear reaction can be distinguished by a measurement of the differential energy loss ΔE and the energy E. The product $\Delta E \times E$ is proportional to Z^2M times a logarithmic term which contains M, Z, and E. It is possible to construct a function based on the expression of the product, which does not depend on energy. The reaction products can be identified by analyzing the output of an analog circuit, which forms an approximation of the desired function. Such a circuit is presented. Two logarithmic pulse amplifiers, two adding circuits, and two attenuators are the essential parts of the system. The logarithmic behavior of the two amplifiers is determined by the forward current characteristic of a diode. (auth)

20800 RADIATION-PULSE TRANSMISSION VIA A LONG CABLE WITHOUT A PREAMPLIFIER AND/OR A PULSE TRANSFORMER. H. Miwa and T. Tohyama (Kobe Kogyo Corp., Okubo, Akashi, Hyogo, Japan). p.421-8 of "Nuclear Electronics. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In English)

In transistorizing a nuclear instrument, some revision of the input circuit is needed because of its inherent low input impedance. Three input circuits of voltage mode (No. 1), voltage-current mode (No. 2), and current mode (No. 3) are considered and compared. No. 1 mode is similar to the conventional vacuum tube circuit. The super-alpha bootstrapped emitter-follower with feedback biasing was de-

vised and used successfully as a high input-impedance circuit of greater than 10 MΩ without spoiling the DC stability. Almost all radiation detectors can be considered as current generators. Thus the output of detectors can be connected to the low input-impedance current amplifier. This is mode No. 3 which gives excellent pulse height, but the upper frequency limit of the amplifier should be higher than 10 Mc because of the fast current pulse and low input-integrating time-constant. Mode No. 2 is the combination of Nos. 1 and 3. The output of detectors is connected through a resistor of about 100 kΩ to the low input-impedance current amplifier. The resistor alters the input-integrating time-constant to the adequate value and lessens the electric circuit demand of the upper frequency limit to about 2 Mc. Moreover, the proportion of pulse height to radiation energy can be maintained. The resistor also serves as a safety device for gaseous detectors. The cable between the resistor and the current amplifier can be extended over 500 m without pulse-form distortion if a coaxial cable is employed while the amplifier input impedance of mode No. 2 is adjusted so as to match the characteristic impedance of the cable by a series of variable resistors. Thus mode No. 2 has been widely adopted for nuclear instruments such as a neutron soil-moisture gage (BF_3 counter), a soil-component analyzer (scintillation spectrometer), snow gage (GM counter), and remote monitors. No preamplifier and no pulse transformer enables the operation of detectors in extreme environmental conditions such as high or low temperature, high neutron (gamma) flux, etc. A single coaxial cable enables the simple operation of detectors in remote positions. Scintillation gamma spectroscopy was not affected by a long cable pulse-transmission of over 500 m. (auth)

20801 TRANSISTOR-DRIVEN DECADE COUNTER TUBES. M. Birk, H. Brafman, G. Inbar, M. Korman, M. Sidi, and J. Sokolowski (Weizmann Inst. of Science, Rehovoth). p.429-36 of "Nuclear Electronics. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In English).

The possibilities of using transistors as drivers for the three existing types of decade counter tubes, namely, gas-filled decatrons, vacuum decatrons, and magnetic beam-switching tubes, have been investigated. The Elesta gas-filled decatron EZ10B could be driven up to 800 kHz by a blocking oscillator using a PSI 2N1339 Mesa transistor. However, considering its price and reliability, the EZ10B seemed most suitable for a 250-kHz scaler using ordinary transistors, such as OC44 and 2N398, as drivers. In the self-locking mode of operation, the Philips E1T vacuum decatron was driven up to 50 kHz using 2N247 transistors in conventional circuitry. However, it was found practically impossible to use transistors alone to drive the E1T in the fast model of operation, that of directly driving the locking deflection plate. The addition of a single ECC83 vacuum tube enabled a double-pulse resolution of 0.3 μs to be obtained. With the new Burroughs BX1000 magnetic beam-switching tube a 0.3 μs double-pulse resolution was achieved, using a flip-flop type driver employing 2N247 transistors. A direct Nixie readout has been used. Scalers using the three types of decade tubes and incorporating a precision discriminator and a provision for gating are described. (auth)

20802 NEW COUNTING CIRCUITS WITH E1T TUBES. V. Radeka (Institut Rudjer Bošković, Zagreb). p.437-43 of "Nuclear Electronics. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In English)

New solutions for beam-deflection circuits are given, which result in simple and reliable counting circuits. The requirements on the accuracy of the beam deflection are derived from a theoretical investigation of the counting process. The decrease in deflection error limits resulting from the difference between real and idealized tube characteristics is calculated. It is shown that, up to about 3×10^6 pulses per second, the deflection error is maximum and independent of the counting speed, enabling simpler circuits to be obtained. More accurate deflection circuits are needed for counting up to 10^6 pulses/sec. Two circuits for use up to these counting speed limits are presented. The requirements put on circuit components regarding stability and accuracy are low. Only an unstabilized d-c supply voltage is needed. (auth)

20803 NEW SIMPLE LOGARITHMIC COUNTING-RATE METER. V. N. Kostić and B. J. Kovač (Nuklearni Institut "Boris Kidric," Vinča, Yugoslavia). p.445-50 of "Nuclear Electronics. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In English)

The basic circuit and the design method for a multidecade logarithmic counting-rate meter, developed especially for fully transistorized portable instruments are described. The logarithmic linearity, relative to the periodic and random pulses (Poisson distribution), as well as the dead-time influence of the random pulses source on the logarithmic law, is analyzed. (auth)

20804 MEMORIZING CIRCUIT FOR LONG PULSES. M. Coli and G. Horn (Sorin Centro Ricerche Nucleari, Saluggia, Italy). p.451-9 of "Nuclear Electronics. Vol. II." Vienna, International Atomic Energy Agency, 1962. (In English)

The circuit allows unlimited memorization of a positive pulse of any shape, and retains both amplitude and width. Theoretically a rectangular pulse of amplitude A and width t produced as a single pulse when t = 0 can be reproduced in its own area after any time τ, so that it may be retained on an oscilloscope synchronized at a repetition frequency $\simeq 1/\tau$. The rise form of pulse is not memorized, so that the pulse rise and decay time retained by the oscilloscope are those inherent to the memorizing circuit. Basically the circuit may be considered as being formed by two stretching circuits. These transform the input width from t to $t + \tau$. The lengthened pulses of opposite phases are added to obtain at the output a pulse of amplitude A and width t. The delay τ is controlled by two monostables triggered at an interval t (delay control circuit) by a saturated amplifier which squares the input and gives two pulses, through a differentiating circuit (delay-measuring circuit). The output pulse is fed back to the input through an attenuator and a delay line. The cycle is repeated with a repetition rate of $\sim 1/\tau$. The memorized pulse has a width from 50 μs to over 10 ms. The repetition rate may vary from 10^4 Hz to 30 Hz and less. (auth)

Materials Testing

20805 (ARL-181) A UNIFIED ENGINEERING THEORY OF HIGH STRESS LEVEL FATIGUE. S. R. Valluri (California. Inst. of Tech., Pasadena. Guggenheim Aeronautical Lab.). Dec. 1961. Contract AF 33(616)-6270. 47p.

A unified engineering theory of high stress level fatigue is proposed which enables an understanding and allows prediction of the various aspects of fatigue from the same basic model. This model combines certain features of dislocation theory of metals with elasto-plastic analysis of the stress distribution near a crack, and permits an estimate of fatigue life to failure based upon estimates of the rate of crack propagation. The theory predicts the shape of the

familiar stress versus number of cycles curve extending from one fourth of a cycle at the ultimate static tensile strength down to several million cycles and incorporates no additional assumptions in predicting cumulative damage during fatigue. In particular, the theory distinguishes the order of application of stresses in cumulative damage. The weighting factor frequently associated with high stress levels in cumulative damage is implied in the basic model itself. The theory also discusses the dependence of fatigue upon the several commonly observed variables, some quantitatively and some qualitatively, as well as residual static strength in fatigue and its dependence on material properties. The inherently statistical nature of the fatigue problem is emphasized and this is attributed to an internal stress existing at the level of the lattice structure. This stress is thought to be due primarily to the existence of a network of dislocations and the solute atoms of alloying elements. (auth)

20806 (NAA-SR-6376) CALCULATION OF MECHANICAL BEHAVIOR OF MATERIALS THROUGH TRUE STRESS-TRUE STRAIN RELATIONSHIPS. W. J. Anderson (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). June 15, 1962. Contract AT (11-1)-GEN-8. 31p.

The limitations of conventional mechanical test data cause the information to be useful, in design, only as an approximation. Conventional mechanical test data cannot be used to determine quantitative effects of notches, welds, and metallurgical instability. The behavior of materials under various loading modes in conventional mechanical tests cannot be correlated from reported information. It is proposed that the true stress-true strain relationships, occurring during loading of specimens under various loading modes, provide a means for the quantitative correlation of the results. It is also proposed that the true stress-true strain relationships found in mechanical tests may be extended to calculate the structural behavior of materials under predicted service loading conditions. The correlatior method is based on a parameter, $M_L = d[n\ \sigma_t/d\epsilon_t$, which is determined from the curve of true stress vs true strain in a short-time tensile test. This parameter (which has been called the "log modulus"), when plotted as a function of applied stress and specimen geometry, allows quantitative correlation between short-time tensile tests and constant-load creep-rupture tests. Total true creep strain is used as a criterion for failure under creep conditions. Calculations by this method, based on a 2-in. radius notched Type 304 stainless steel specimen, under an engineering stress of 45,000 psi, predicted a rupture life of 408 hr, a true strain at failure of 0.23 in./in., and a true stress of 56,200 psi. Failure of the test specimen in a test was observed in 370 hr, with a true strain of 0.265 in./in., at a true stress of 57,500 psi. It is suggested that the dependence of the M_L parameter on strain history and metallurgical change may be used to evaluate materials behavior under changes in loading or temperature conditions in long-time service. (auth)

20807 (NP-11694) DEVELOPMENT OF METALLOGRAPHIC AND X-RAY PROCEDURES FOR DETERMINING THE SOUNDNESS OF Cb-1% Zr WELDS. Final Report on Task 302. William Arbiter (United Nuclear Corp. Development Div., White Plains, N. Y.). Jan. 30, 1962. 21p. (MTL-2350)

An investigation was conducted to determine the effects of gas purity on the ductility, hardness, and structure of welds in Nb-1% Zr alloy. It was found that a gas impurity level exceeding 180 ppm O equivalent cannot be tolerated if ductile welds are made. A gas purity indicator is recommended for use with bend tests to indicate the proper atmosphere purity. (J.R.D.)

20808 (PNE-105P) STRESS HISTORY MEASUREMENTS WITH PIEZOELECTRIC CRYSTALS. Preliminary Report. M. Heusinkveld, F. Holzer, R. Marks, and C. Sisemore (California. Univ., Livermore. Lawrence Radiation Lab.). Mar. 1962. Project GNOME. Contract [W-7405-eng-48]. 23p.

The radial and transverse compressive stresses in the salt medium surrounding Gnome detonation were measured at various distances from the explosion center using tourmaline piezoelectric crystals. Data analysis is incomplete, however, a summary of general indications is included. (J.R.D.)

20809 RADIOGRAPHIC BEHAVIOR OF GRAPHITE AND BERYLLIUM. D. E. Elliott, J. L. Stokes, and G. H. Tenney (Los Alamos Scientific Lab., N. Mex.). Nondestructive Testing, 20: 161-6(May-June 1962).

The radiographic behavior of graphite and beryllium was investigated. Since secondary and scattered radiation can prove most detrimental to radiographic quality, the amount and degree of these types of radiation were determined. Data were obtained on the 90 deg scatter, and film density ratios in the forward direction (buildup scatter) were empirically established. Exposure technique curves were obtained for thicknesses of graphite up to 30 in. and for thicknesses of beryllium up to 7 in. by using a suitable range of x-ray and gamma energies. Various methods of combating scatter radiation were explored. Relative radiographic resolutions and sensitivities, with and without controlled scatter, are presented. It was concluded that high quality radiography can be performed on these materials with the use of some specialized techniques. (auth)

20810 A DISCUSSION OF NEUTRON RADIOGRAPHY. Harold Berger (Argonne National Lab., Ill.). Nondestructive Testing, 20: 185-92; 194(May-June 1962). (ANL-46F-294)

The advantages of neutron radiographic inspection are discussed, and the methods which can be used to perform neutron radiography are outlined. Several neutron image detection methods are recommended, covering a variety of possible speed values, image resolution qualities, and exposure situations. Some practical examples of neutron radiography are included, along with suggestions for other application possibilities. (auth)

20811 IMPROVEMENTS IN OR RELATING TO APPARATUS FOR DETERMINING THERMAL STRESSES. Jean Louis Bernard, Maurice Gauthron, and Andre Gautier (Commissariat a l'Energie Atomique). British Patent 897,937. May 30, 1962.

An apparatus is designed for determining thermal stresses arising in an element having two portions subjected to two different temperatures. The apparatus includes two elementary expansion-measuring machines for measurements on two identical test-pieces. The first machine places no load other than expansion on its test-piece, but the second machine is adapted for applying a load to its test-piece to keep its length equal to that of the test-piece in the first machine. Results of a test conducted on Z.W. 1 alloy (Mg−Zr−Zn) are given. (D.L.C.)

GEOLOGY, MINERALOGY, AND METEOROLOGY

20812 (A/AC.82/G/L.711) LA RETOMBEE RADIOACTIVE A MOL. RAPPORT D'AVANCEMENT 1er SEMESTRE 1960. (Radioactive Fall-out at Mol. Progress Report for 1st Six Months of 1960). R. Boulenger and E. Van der Stricht (Brussels. Centre d'Étude de l'Énergie Nucléaire). Nov. 1960. 72p.

The semi-annual progress report on the fall-out measured at Mol is presented. The results of measurements on the radioactivity of the air, the total fall-out, the determination of Sr^{90}, the determination of Cs^{137}, and meteorological data are presented in tabular form. (J.S.R.)

20813 (A/AC.82/G/L.721) LA RETOMBEE RADIOACTIVE A MOL. RAPPORT D'ADVANCEMENT 2eme SEMESTRE 1960. (Radioactive Fall-out at Mol. Progress Report for the Second Half of 1960). R. Boulenger and E. Van der Stricht (Brussels. Centre d'Étude de l'Énergie Nucléaire). July 1961. 56p.

The second semi-annual progress report on the fall-out measured at Mol is presented. The results of measurement on the radioactivity of the air, the total fall-out, the determination of Sr^{90}, the determination of Cs^{137}, and meteorological data are shown in tabular form. (J.S.R.)

20814 (NP-11603) GEOPHYSICAL EXPERIMENTS PERTINENT TO NUCLEAR BLACKOUT STUDIES. Final Report. I. G. Poppoff, T. O. Passell, R. A. Young, R. C. Whitten, E. T. Pierce, J. B. Chown, S. D. Softky, R. B. Dyce, J. E. Nanevicz, A. H. Samuel, C. J. Cook, E. F. Vance, and D. C. Lorents (Stanford Research Inst., Menlo Park, Calif.). Dec. 31, 1961. 198p.

Results are presented of a study concerning geophysical experiments involving naturally occurring ionizing events. Included is a review of nuclear-weapon-emitted radiation characteristics. The atmospheric effects of these radiations are discussed and similarities between nuclear weapons effects and solar-terrestrial relations are examined. A general research program is suggested along with suggestions concerning rocket probe experiments using geophysical events. The experiments are evaluated in relation to their value in obtaining information on nuclear weapons effects. (J.R.D.)

20815 (NYO-7831) A STREAM SURVEY IN THE URANIUM MINING AND MILLING AREA OF THE COLORADO PLATEAU. COLORADO AND GUNNISON RIVERS. James M. Morgan, Jr. (Johns Hopkins Univ., Baltimore). Dec. 1959. Contract AT(30-1)-1477. 246p.

During June to August 1958, a stream survey was made of the Colorado-Gunnison River System in Colorado during a period of infrequent rainfall and near-minimum runoff. Approximately one hundred and seventy miles of the Colorado River and one hundred and thirty miles of the Gunnison River were investigated. Water samples were analyzed chemically, physically, and radiologically; aquatic organisms were identified and bacteriological samples taken. River bottom silt and mud samples as well as irrigation area soil samples were investigated radiologically. Three uranium ore reduction mills employing the solvent extraction process were located in the survey area. (auth)

20816 (NYO-9531) STUDIES OF NUCLEAR DEBRIS IN PRECIPITATION. Progress Report No. 8, July 1960–June 1961. Alan Walton, Edwin L. Fisher, and Philip W. Krey (Isotopes, Inc., Westwood, N. J.). Jan. 15, 1962. Contract AT(30-1)-2415. 58p.

The concentrations of Ce^{144} in ground-level air and precipitation at Westwood, New Jersey during the period July 1960 to June 1961 were studied. On a daily basis the air concentrations changed quite frequently by factors of two and three but the concentrations of Ce^{144} in rainfall exhibited much greater variability. Ground-level air did not reflect changes in Ce^{144} concentration in the upper troposphere as rapidly as the precipitation. For approximately 75% of the rains occurring in the latter half of 1960 only about 10% of the Ce^{144} present within the air column above the collector to 20,000 feet needs to be removed by precipitation to produce the observed deposition. In a meteorological examination of the factors influencing the concentrations of Sr^{90} and Ce^{144} in precipitation during a single rainstorm in April 1961 three facts emerged. At the beginning of the storm there was a pronounced decrease in the concentrations of both nuclides. Following a period of rather constant concentrations there was an increase by a factor of two at a time which coincided with the minimum in tropopause height. Toward the end of the storm a new uncleansed continental air mass appeared over the area and the concentrations of radioactivity in the precipitation increased. (auth)

20817 (PNE-126F) WEATHER AND SURFACE RADIATION PREDICTION ACTIVITIES. Final Report. (Weather Bureau, Las Vegas, Nev.). Apr. 27, 1962. Project GNOME. 25p.

Responsibilities and functions of the weather and radiation prediction unit in support of project GNOME are summarized. (J.R.D.)

20818 (RME-4517) RECONNAISSANCE FOR URANIUM IN THE MOQUEGUA-ILO AREA, DEPARTMENT OF MOQUEGUA, PERU. Lawrence J. Brown, Guillermo Morales S., and Adolfo Ocampo A. (Division of Raw Materials, AEC and Peru. Junta de Control de Energia Atomica, Lima). Feb. 1958. 10p.

In 1958 geologic and radiometric examinations in the Moquegua-Ilo area of southern Peru disclosed no anomalous radioactivity, although favorable structures were observed in a large expanse of Tertiary continental sediments. It is believed that the area warrants further investigation, possibly by aerial reconnaissance. (auth)

20819 (RME-4521) RECONNAISSANCE FOR URANIUM IN THE PROVINCES OF CHOTA AND HUALGAYOC, DEPARTMENT OF CAJAMARCA, PERU. Lawrence J. Brown and Francisco Cűtolo L. (Division of Raw Materials, AEC and Peru. Junta de Control de Energia Atomica, Lima). Dec. 1957. 9p.

In 1957 two Upper Cretaceous formations in the Department of Cajamarca in northwestern Peru were reconnoitered geologically and radiometrically. The area does not appear to be geologically favorable for the occurrence of uranium minerals, and no anomalous radioactivity was found. (auth)

20820 (RME-4568) RECONNAISSANCE FOR URANIUM IN THE ARICA AREA, PROVINCE OF TARAPACA, CHILE. Mario Serrano C. and Erik Klohn H. (Division of Raw Materials, AEC and Chile. Instituto de Investigaciones Geőlogicas, Santiago). Dec. 1960. 13p.

In August 1958 two geologists of the Instituto de Investigaciones Geológicas de Chile made a one-week reconnaissance for uranium of the Arica area in northern Chile. Slightly anomalous radioactivity was noted in shear zones in and near the outer margins of a tourmalinized breccia

zone and in fractures weakly mineralized with copper located between the Campanani and the Dos Hermanos mines. (auth)

20821 (SC-4853(RR)) DEFINING EXTREME DESERT ENVIRONMENTS WITH MICROCLIMATOLOGICAL MEASUREMENTS. C. A. Scott (Sandia Corp., Albuquerque, N. Mex.). May 1962. Contract [AT(29-1)-789]. 25p.

Desert storage requirements are often described by record temperature extremes and hypothetical daily temperature cycles. This method has limited utility and can result in unrealistic design and test criteria. A more realistic low-altitude desert environment is described in curves drawn from hourly temperature, relative humidity, and solar radiation values. The data were collected during periods of extreme high temperatures in Death Valley, California. These curves, which represent a microclimatological approach, can be used as a common point of departure in describing desert climates. Mathematical expressions derived from the curves can be used for calculating the response of equipment to a desert environment and as an aid in preparing design criteria for an item facing exposure in an uncontrolled desert environment. (auth)

20822 AERIAL PROSPECTING FOR RADIOACTIVE MINERALS. J. H. Quilty. Atomic Energy, 5: No. 2, 19-21(Apr. 1962).

The use of highly sensitive scintillation counters in aerial prospecting is discussed. Conditions for detection, DC-3 surveys, and low-level search are described. Methods of interpreting results are outlined. (M.C.G.)

20823 EFFECT OF THE DEPTH OR THE ALTITUDE OF AN EXPLOSION ON THE SEISMIC SIGNALS. Yves Rocard. Compt. rend., 254: 2404-6(Mar. 26, 1962). (In French)

Because of a law of dimensions, the exploitation of the results of numerous chemical shots and some nuclear shot yields a law fixing the seismic amplitude as a function of the altitude or depth of an explosion. (tr-auth)

20824 THE DISCOVERY OF URANIUM-BEARING CHRISTOBALITE AND TRIDYMITE IN LIMESTONE. N. A. Glagolev. Doklady Akad. Nauk S.S.S.R., 143: 1421-3 (Apr. 21, 1962). (In Russian)

Uranium-containing siliceous formations were found in a limestone block on the boundaries of a large pre-Cambrian anticline in a tectonic contact zone. The christobalite and tridymite form layered veins 0.3 to 0.4 m thick. The presence of these minerals was confirmed by x-ray analyses and by measurement of the refractive indices. Chemical analyses showed 0.12% uranium in the christobalite and 0.32% uranium in the tridymite. Both minerals fluoresce with a dark green color under ultraviolet light. Radiographs show a homogeneous distribution of uranium. This type of mineralization requires further study, since there is scarcely any mention of it in the literature. (TTT)

20825 THE FORM OF URANIUM IN APATITE. M. B. Serebryakova and E. G. Razumnaya (All-Union Inst. of Minerals, USSR). Doklady Akad. Nauk S.S.S.R., 143: 1438-41(Apr. 21, 1962). (In Russian)

Although U(IV) and Ca have similar ionic radii, it is shown that U(IV) does not isomorphously replace Ca in an apatite of metasomatic origin, but rather uranium is present in the apatite mineral as an oxide impurity. The experimental method consisted of leaching a finely-ground sample of apatite mineral with successive portions of weak HCl (pH of 3.0 to 0.3% HCl), citric acid (0.1, 5, and 10%), or 10% $NaHCO_3$ solution containing a little $KMnO_4$. The uranium was extracted much more rapidly than Ca, P, and F which were uniformly extracted. The results of an electrodialysis experiment showed again that the uranium was more readily extracted from the ore than Ca, P, and F were. Almost identical results were obtained on repeating the experiments with a synthetic mixture of apatite and pitchblende. (TTT)

20826 CESIUM UPTAKE BY SACLAY SOIL. C. Gailledreau (Commissariat a l'Energie Atomique, Paris). Energie nucleaire, 4: 120-3(Mar.-Apr. 1962). (In French)

The adsorptive properties of Saclay soil for cesium are measured and expressed in terms of partition coefficients. It is found that cesium uptake does not follow the Langmuir isotherm, except for extremely low concentrations. Cesium is very selectively adsorbed, however, and its movement in such a soil is extremely slow. (auth)

20827 THE TRITIUM CONTENT OF THREE STONY METEORITES AND ONE IRON METEORITE. A. E. Bainbridge, H. E. Suess, and H. Waenke (Univ. of California, La Jolla, San Diego). Geochim. et Cosmochim. Acta, 26: 471-3(Apr. 1962). (In English)

Tritium determinations for the chondrites, Bruderheim and Harleton, gave values in line with determinations of other radioisotopes. For Walters a terrestrial age of a little over one tritium half life can be estimated. This supports the generally accepted view that its time-of-fall is identical with the observation of a spectacular fireball in the same area shortly before the find. As was previously found, the iron, Aroos, contains an order of magnitude less tritium that is expected on theoretical grounds. (auth)

20828 RADIOCARBON CONTENT AND TERRESTRIAL AGE OF TWELVE STONY METEORITES AND ONE IRON METEORITE. H. E. Suess and H. Waenke (Univ. of California, La Jolla, San Diego). Geochim. et Cosmochim. Acta, 26: 475-80(Apr. 1962). (In English)

The radiocarbon content of twelve stony meteorites, six with observed time-of-fall and the others finds, and that of an iron, (Aroos), was determined. The average contemporaneous radiocarbon content of the falls was found to correspond to 48.2 disintegrations/min. A much lower value of 5.4-disintegrations/min was found for the iron. Of the six finds, two were found to be Pleistocene. The average C^{14} content of the finds investigated indicates that terrestrial ages of the order of a thousand years are quite common. (auth)

20829 THE ISOTOPIC COMPOSITION OF SILVER IN IRON METEORITES. V. Rama Murthy (Univ. of California, La Jolla, San Diego). Geochim. et Cosmochim. Acta, 26: 481-8(Apr. 1962). (In English)

Microgram quantities of silver were extracted from the troilite of Toluca iron meteorite and the metal phases of Sikhote Alin and Canyon Diablo meteorites using anion-exchange techniques. Isotopic analysis of silver in iron meteorites indicates a 2–3% higher Ag^{107}/Ag^{109} ratio relative to the terrestrial silver. If this excess Ag^{107} is attributed to the decay of the extinct radioactive nuclide Pd^{107}, an unreasonably short interval of time between the end of nucleosynthesis and the formation of iron meteorites is indicated. The silver isotopic anomaly in iron meteorites appears too large to be attributed entirely to Pd^{107} produced in the galactic synthesis of elements, and may have to be interpreted in terms of a last-minute contribution of some amounts of short-lived radioactivities to the solar nebula, or by postulating that some Pd^{107} was produced in the solar system in its early stages, after its separation from the galactic nucleosynthesis. (auth)

20830 VALUES FOR TRACE ELEMENTS IN G-1 AND W-1 WITH NEUTRON ACTIVATION ANALYSIS. II. Mo, Sn, Ta, W. Hiroshi Hamaguchi, Rokuro Kuroda, Tsuneo Shimizu, Iwao Tsukahara, and Ryuichi Yamamoto (Tokyo Univ. of Education). Geochim. et Cosmochim. Acta, 26: 503-5(Apr. 1962). (In English)

Neutron activation analyses were made of Mo, Sn, Ta, and W in standard rocks G-1 and W-1. The amounts of the elements were estimated by comparing Mo^{99} (67 hr), Sn^{121} (27.5 hr), Ta^{182} (111 d), and W^{187} (23.9 hr) β activities isolated from the sample with those from the monitor. A correction for the contribution of Mo^{99} from uranium fission was made for the estimation of Mo. The results are tabulated. (P.C.H.)

20831 THE CONTENTS OF SEVERAL TRACE ELEMENTS IN THE STANDARD ROCKS G-1 AND W-1. Maria C. Clark and D. J. Swaine (Commonwealth Scientific and Industrial Research Organization, Chatswood, New South Wales, Australia). Geochim. et Cosmochim. Acta, 26: 511-14(Apr. 1962). (In English)

The contents of approximately 20 trace elements in the standard rocks G-1 and W-1 are given. These were determined by a spectrographic method, using the powdered sample and anode excitation in a d-c arc. (auth)

20832 Ta IN THE GRANITE G-1. J. R. Butler and A. J. Thompson (Imperial College, London). Geochim. et Cosmochim. Acta, 26: 516-17(Apr. 1962). (In English)

The analysis of tantalum in granite G-1 was made by neutron activation and also by x-ray fluorescence and the results were compared. Values obtained for G-1 by neutron activation were 0.80, 0.87, 0.89, and 1.0 ppm Ta; average 0.90. A sample of albite-riebeckite-granite from Northern Nigeria was found to contain 107 ppm Ta by activation analysis and 105 ± 10 ppm by x-ray fluorescence. It is concluded that all Ta values discussed for G-1 give plausible Nb/Ta ratios when Nb is taken as 20 ppm. (P.C.H.)

20833 SUMMARY OF NEW DATA ON ROCK SAMPLES G-1 AND W-1. Michael Fleischer and R. E. Stevens (Geological Survey, Washington, D. C. and Menlo Park, Calif.). Geochim. et Cosmochim. Acta, 26: 525-43(May 1962). (In English)

Published and unpublished analyses for major and minor constituents that have become available since April 1960, were collected for the granite G-1 and diabase W-1. "Best values" are suggested for some of the elements. (auth)

20834 COFFINITE AND NATURE OF NASTURAN PSEUDOCRYSTALS. Yu. M. Dymkov and N. G. Nazapenko. Geokhimiya, No. 4, 304-12(1962). (In Russian)

An analysis was made of various reactions between uranium silicates, hydroxides, and oxides, and a possible origin of nasturan pseudocrystals was suggested. Mineralographic and x-ray studies showed that nasturan crystals have isotropic coffinite or pseudomorphic nasturan structure. The feasibility of finding the intermediate nasturan and coffinite system was discussed. (R.V.J.)

20835 RARE EARTHS IN POLAR URAL MOUNTAIN PERIDOTITE. Yu. A. Balashev and N. V. Turanskaya (Vernadskii Inst. of Geochemistry and Analytical Chemistry, Academy of Sciences, Moscow). Geokhimiya, No. 4, 377-8(1962). (In Russian)

Gravimetric and x-ray analyses were used for determining the rare earth content in peridotite. The analyses confirmed a postulation on relatively high enrichment of substrata and ultra-substrata in yttrium groups. (R.V.J.)

20836 DISPERSION AND PERSISTENCE OF TRACER IN RIVER FLOW MEASUREMENTS. D. E. Hull (California Research Corp., Richmond). Intern. J. Appl. Radiation and Isotopes, 13: 63-73(Feb. 1962). (In English)

The total-count method was demonstrated to be useful for accurate measurement of the flow in turbulent natural streams over a range of 5 to 1000 ft^3/sec. Duplicate measurements were reproducible to 1%, and the absolute accuracy is within 5%. The distance along the stream from where the tracer is added to where it is counted must be great enough to allow complete transverse mixing of the tracer. However, it should not be so great that longitudinal dispersion spreads the tracer over a time too long for convenient measurement. There is a considerable latitude between these limits where the highest accuracy can be attained. Within these limits, Au^{198} persists in the stream with losses too small to affect the accuracy. One man, unassisted, can measure the flow rate of a stream in one or two hours. The longitudinal dispersion of a tracer wave can be represented roughly by a Gaussian error function over a small segment of a stream. The mixing coefficient D varies with the dimensions and contour of the stream bed. Values from 80 to 270 ft^2/sec were found for adjacent segments of the same stream. A rough correlation of D with the size and velocity of the stream was found: $D \cong 2.5\ (Qv)^{1/2}$. Based on this, a formula was derived for the distance required for complete transverse mixing in a turbulent stream: $L_{min} = aQ^{1/2}$. If L is expressed in feet and Q in ft^3/sec, the value of a is about 200 when the tracer is added at one edge, and about 50 when it is added in mid-stream. (auth)

20837 A MULTI-LAYER MODEL FOR THE STUDY OF ACOUSTIC-GRAVITY WAVE PROPAGATION IN THE EARTH'S ATMOSPHERE. Richard L. Pfeffer (Columbia Univ., Palisades, N. Y.). J. Atmospheric Sci., 19: 251-5 (May 1962).

An iterative numerical procedure, suitable for use on electronic computers, is presented for calculating the horizontal propagation speeds of acoustic-gravity waves in a stratified atmosphere. The atmosphere is represented by large series of isothermal layers, so that propagation can be studied in an atmosphere with a complex stratification. The approach is similar to that used in seismology. A calculation shows reasonable agreement with the exact two-layer solution of Pekeris. (auth)

20838 ACOUSTIC-GRAVITY WAVE PROPAGATION FROM NUCLEAR EXPLOSIONS IN THE EARTH'S ATMOSPHERE. Richard L. Pfeffer and James Zarichny (Columbia Univ., Palisades, N. Y.). J. Atmospheric Sci., 19: 256-63 (May 1962).

To account for characteristic features of atmospheric pressure oscillations produced by nuclear explosions, a numerical matrix method is used to solve equations governing the horizontal propagation of acoustic-gravity waves in a stratified atmosphere. Solutions for three- and four-layer models are in qualitative agreement with the observations. They show normal dispersion (group velocity increasing with period) at 1 to 10 min, and inverse dispersion (group velocity decreasing with period) at the shorter periods and, for some models, at 5 to 15 min. (auth)

20839 ATMOSPHERIC WAVES FROM NUCLEAR EXPLOSIONS. PART II. THE SOVIET TEST OF 30 OCTOBER 1961. William L. Donn and Maurice Ewing (Columbia Univ., Palisades, N. Y.). J. Atmospheric Sci., 19: 264-73 (May 1962).

Atmospheric waves from the Soviet nuclear test of Oct. 30, 1961 are described for nine stations having wide global distribution. The records are characterized by waves which begin with the highest amplitudes and show normal dispersion. These appear to be superimposed on a

lower-amplitude, long-period train of waves showing inverse dispersion. As shown on dispersion curves of group velocity against period, a maximum of group velocity is indicated by the Airy phase formed through the merging of the two dispersive trains. A more prolonged train of waves of nearly uniform period is attributed to higher modes. The direct waves from the epicenter to the stations give dispersion curves that indicate significant variation in atmospheric structure along different azimuths and probably along different segments of the same azimuth. The curves for waves which have traveled more than once around the earth represent better sampling of world-wide atmospheric conditions and give better agreement with preliminary theoretical models. The average speed of the first arrivals is 324 m per sec, comparing well with the maximum obtained for the Krakatoa eruption. (auth)

20840 THE DETERMINATION OF AQUIFER PARAMETERS WITH THE AID OF RADIOACTIVE TRACERS. E. Halevy and A. Nir (Weizmann Inst. of Science, Rehovoth, Israel). J. Geophys. Research, 67: 2403-9(June 1962).

The effective porosity of a dolomite aquifer was determined by tracing a pulse of radioactive $K_3Co^{60}(CN)_6$ between two wells 250 meters apart. Coordinate transformation of the obtained activity curve was applied for the calculation of the porosity from experimental results. (auth)

20841 THE RARE-EARTH DISTRIBUTION IN SEDIMENTS. Larry Haskin and Mary A. Gehl (Univ. of Wisconsin, Madison). J. Geophys. Research, 67: 2537-41(June 1962).

Neutron-activation analyses confirm the essential constancy of the relative abundances of rare-earth elements for most sediments. Values for yttrium and some of the lanthanides in the Forest City chondrite are given. The yttrium content of 2.15 ppm corresponds to 4.1 atoms of yttrium per 10^6 silicon atoms for chondrites. Possible reasons for the difference in the sediment and chondrite rare-earth distributions are considered. (auth)

20842 THE EHOLE METEORITE, ITS ACQUISITION AND ITS RADIOACTIVITY. E. L. Fireman (Smithsonian Astrophysical Observatory, Cambridge, Mass.). J. Geophys. Research, 67: 2592-4(June 1962).

A meteorite fell at 17°15′ S, 15°50′ E, in Angola, on Aug. 31, 1961. The meteorite was composed principally of olivine, with some free metal and smaller amounts of sodium feldspar and troilite. The Ar^{37}, Ar^{39}, and T concentration in the meteorite were determined. (T.F.H.)

20843 AGE OF THE CUDDAPAHS, INDIA. R. D. Russell and W. F. Slawson (Univ. of British Columbia, Vancouver). Nature, 194: 565-6(May 12, 1962).

Results are given of recomputations carried out on the spectrograms of the Zangamrajupalle galena made by U. Aswathanarayana with a Waltair mass spectrometer. The discrepancy of the results from the calculations of Aswathanarayana is due chiefly to the effects of peak tailing, and corrections for the tailing are discussed. The possibility of pressure scattering as a further source of uncertainty in lead isotope analyses is pointed out. A reply from Aswathanarayana is given in which he discusses the discrepancy and the implications of the corrected lead isotopic com, sition of the Zangar ajupalle galena. (D.L.C.)

20844 URANIUM IN RECENT JAPANESE SEDIMENTS. Yukio Sugimura (Meteorological Research Inst., Tokyo) and Toshiko Sugimura. Nature, 194: 568-9(May 12, 1962).

Samples of sediments, of which two were marine, three from inlets, four sections of a core from a brackish lake, one from an oilfield, and one from a gasfield, were analyzed for their U contents. The U contents ranged from 1.3 to 18.1 μg U/g, and the high U contents of Lake Hamana and Kagoshima Bay are probably due to reducing conditions. The average U content, excluding the unusually high contents, is 2.5 ppm. (D.L.C.)

20845 POTASSIUM–ARGON AGES ON ROCKS FROM EASTERN GREENLAND. J. L. Kulp (Columbia Univ., New York), R. Kologrivov, J. Haller, and L. Koch. Nature, 194: 953-5(June 9, 1962).

Samples from petrographic collections were analyzed with the potassium-argon method of geochronometry. The implications of the results with respect to the geological history of eastern Greenland are discussed. (D.L.C.)

20846 THE PRESENT STATE OF ATMOSPHERIC CONTAMINATION BY FISSION PRODUCTS. R. Reiter (Universitat, Munich). Naturwissenschaften, 49: 83-4 (1962). (In German)

The atmospheric fission product activity was measured in Germany from August 17 to October 25, 1961, at a mountain station and a valley station, separated vertically by 1.1 km. The fission product activity in the air, in precipitation, and in grass is shown graphically. The results show that in the majority of cases the radioactive aerosols arrive at the mountain station from one hour to a day earlier than at the valley station. The dissemination of radioactivities by vertical currents is discussed. (J.S.R.)

20847 NATURAL RADIOACTIVITY OF COPPER ORES FROM DEPOSITS IN THE REGION OF LOWER SILESIA. Jerzy Grabczak and Jerzy Niewodniczański (Academy of Mining and Metallurgy, Krakow). Nukleonika, 7: 115-22 (1962). (In Polish)

The natural gamma activity of 200 samples of the copper ore from bore-cores of bore-holes situated on the copper deposit in Lower Silesia is measured. Spectrometrical measurements prove that the radioactivity of these ores depends mainly on the admixture of uranium. The existence of some correlation between the concentration of copper in the ores and that of uranium is stated. As an example four profiles of bore-holes are shown. The concentration of uranium in ores is given in terms of the exposure dose power in the bore-hole. Maximum radioactivities correspond generally to the maximum concentration of copper along the bore-hole profiles. Some irregularities are caused by the lithology of the deposit. The results enable an estimation to be made of the natural radioactivity background in the deposit. This estimate is important in the case of the application of radiometrical geophysical methods for copper ores. (auth)

20848 A METHOD FOR DIRECT DOSAGE OF RADON AND THORON CONTAINED IN THE ATMOSPHERE. APPLICATION OF A STUDY OF RADIOACTIVE EQUILIBRIUM IN THESE GASES AND THEIR DESCENDANTS. J. Fontan, D. Blanc, M. Bonnafous, and A. Bouville (Centre de Physique Nucléaire, Faculté des Sciences, Toulouse). Nuovo cimento (10), 23: Suppl. No. 1, 132-43(1962). (In French)

The method used for a direct dosage of Rn^{220} and Rn^{222} is based on the following principle: The air to be analyzed, freed of dusty particles including radioactive descendants, goes through an airproof enclosure (or disintegration chamber) where a certain amount of the Rn^{220} and Rn^{222} content is disintegrated; the particles of descendants are collected, on their way out of the chamber, by a filter paper, the activity α of which is measured subsequently.

The shapes of disintegration curves enable differentiation of the Rn^{222} descendant activity from the activity of Rn^{220} descendants. A second apparatus collecting the air dust gives the activity of the descendants in non-filtered air; the concentration of both gases will be indirectly inferred. A comparison between direct and indirect dosages will prove that, in many cases, radioactive equilibrium between these gases and their descendants are not performed, in the air, on the ground level. (auth)

20849 RADIO-ACTIVITY OF GREEN SAND FROM CHICHALI PASS AREA OF KALABAGH DISTRICT (MIANWALI). M. Nabi Bukhsh (North Regional Labs., Peshawar, India). Pakistan J. Sci. and Ind. Research, 5: No. 1, 48-9 (Jan. 1962). (In English)

Radioactivity measurements with a G-M instrument are reported for four 1-g samples of glauconite from Kalabagh. The net activity ranged from 4.0 to 14.3 cpm above an average background of 38.5 cpm, and the U_3O_8 equivalents were calculated to be 0.029 to 0.104%. (D.L.C.)

20850 A PROBE FOR ACCURATE PLACING OF RADIOACTIVE SOLUTION IN SOIL. Uzi Kafkafi. Soil Sci., 93: 357-8(May 1961).

A probe developed for accurate placing of radioactive solution in clay loam soil is described. Steps in the use of the probe are outlined. Using this probe, a radioactive phosphate solution was applied to 35 different soil depths from 10 to 70 cm in one hour. (M.C.G.)

20851 SUMMARY OF EARLY RESULTS FROM EXPLORER XII. Trans. Am. Geophys. Union, 43: 221-8 (June 1962).

Evaluations of the data transmitted to earth by the Explorer XII Energetic Particles Satellite are reviewed. Experiments on board included experiments on proton-analyzers, magnetometers, trapped-radiation, cosmic-radiation, an ion-electron detector, and a solar cell. Data showed that all experiments worked satisfactorily. Findings indicated that the earth's magnetosphere is an extensive trapping region containing a variety of particles having different characteristics. In general, Explorer XII magnetic-field measurements agreed with those made by earth stations during the flight period. It was also found that solar-proton events occur more often than previously thought. (M.C.G.)

20852 TORII, EGO SYR'EVYE RESURSY, KHIMIYA I TEKHNOLOGIYA. (Thorium Mineral Resources, Chemistry and Technology). G. E. Kaplan, T. A. Uspenskaya, Yu. I. Zarembo, and I. V. Chirkov. Moscow, Atomizdat, 1960. 224p.

A review is given of thorium geochemistry and mineralogy. Analyses are made of the corrosion, radioactivity, physico-chemical properties, metallurgy, and applications of pure and alloyed thorium. (R.V.J.)

20853 TERMICHESKII ISSLEDOVANIYA URANOVIKH I URANOSODERZHASHCHIKH MINERALOV. (Thermal Studies of Uranium and Uranium Bearing Minerals). Ts. L. Ambartsumyan, G. I. Basalova, S. A. Gorzhevskaya, N. G. Nazarenko, and R. P. Khodzhaeva. Moscow, State Publishing House of Literature on Atomic Science and Techniques, 1961. 148p.

The physical and chemical properties of uranium and uranium-bearing minerals are described, and data are given on the standard curves of heating and dehydration. The crystal-optical, x-ray diffraction, luminescence, and chemical methods for determining physical and chemical property changes as functions of temperature are considered. 62 references are included. (R.V.J.)

20854 DEVELOPMENTS IN THE FIELD OF DETECTION AND IDENTIFICATION OF NUCLEAR EXPLOSIONS (PROJECT VELA) AND RELATIONSHIP TO TEST BAN NEGOTIATIONS. HEARINGS BEFORE THE JOINT COMMITTEE ON ATOMIC ENERGY, CONGRESS OF THE UNITED STATES, EIGHTY-SEVENTH CONGRESS, FIRST SESSION, JULY 25, 26, AND 27, 1961. (United States. Congress. Joint Committee on Atomic Energy). 1962. 445p. $1.25(GPO).

A detailed description of Project Vela is presented. It is pointed out that this Department of Defense project is divided into three major portions. The underground portion of the program is called Vela Uniform, the surface-based detection of high altitude detonations is called Vela Sierra, and the program for the space-based detection system is called Vela Hotel. The Atomic Energy Commission is responsible for implementation of that portion of the research program requiring nuclear and large chemical explosions. Progress is summarized in recent developments in methods of detection and identification of underground and high-altitude nuclear explosions. Results are reviewed of seismic research and the developmental aspects of the detection of space shots from ground bases. The technical problems connected with the proposed Geneva control system and the role of the detection and inspection research program in relation to the nuclear test ban proposals and negotiations are discussed. (C.H.)

20855 DEVELOPMENTS IN THE FIELD OF DETECTION AND IDENTIFICATION OF NUCLEAR EXPLOSIONS (PROJECT VELA) AND RELATIONSHIP TO TEST BAN NEGOTIATIONS. SUMMARY-ANALYSIS OF HEARINGS HELD ON JULY 25, 26, AND 27, 1961. (United States. Congress. Joint Committee on Atomic Energy). Apr. 1962. 71p. $0.25(GPO).

HEALTH AND SAFETY

20856 (A/AC.82/G/L.746) RADIOCESIO EN LA DIETA HUMANA. INFORME NO. 67 (Radiocesium in Human Diet. Report No. 67). D. Beninson and J. Kramer (Argentina. Comision Nacional de Energia Atomica, Buenos Aires). 1962. 10p.

The mean daily incorporation of Cs^{137} by people during 1961 and the relative contribution of various types of foods are estimated. The mean concentration of Cs^{137} from fallout in the Argentine diet was 12 $\mu\mu c$/kg, which implies a mean daily incorporation of 40 $\mu\mu c$. Foods of animal origin (meat, milk, and derivatives) contribute approximately 80% of the Cs^{137} ingested. The concentration of Cs^{137} in milk, averaged over several months, appears to reflect the fallout as it occurs and not to depend on the accumulation in the soil. Some results suggest that the milk contamination is proportional to the mean concentration of Cs^{137} in the drinking water of the periods considered. The mean annual level of Cs^{137} in milk has not seemed to vary in the last two years. Some considerations on the relationship between the contamination levels of the various foods rest on the assumption that the annual incorporation of radiocesium varies little in the same period. (tr-auth)

20857 (AD-265757) HIGH LEVEL RADIATION POLYMERIZATION DOSIMETRY. Report No. 2 (Final), June 16, 1960–June 16, 1961. Frank E. Hoecker. Contract DA19-129-qm-1644. 37p.

Investigations were made of methods of chemical dosimetry which were proposed and tested. The test equipment has its own self-contained mechanism for indicating the amount of product resulting from exposure to radiation. This system is designated as radiation polymerization (Radipol) dosimetry because it utilizes the products of radioinduced polymerization. Its feature is a change of state from liquid to solid which serves as a sharp, irreversible end-point to indicate, without the use of auxiliary equipment, the delivery of any predetermined dose of x rays, gamma rays, or electron beam energy. The basic constituent of this dosimetric system is a liquid monomer which is susceptible to non-linear addition polymerization to form an infinite network of polymer molecules. This may be brought about by an added initiator, by heat, light, or high energy ionizing radiation. (auth)

20858 (AECL-1518) EXPERIENCE WITH DILUTION RATE FACTORS FROM THE AECL REACTOR STACK. G. C. Butler and P. J. Barry (Atomic Energy of Canada Ltd., Chalk River, Ont.). May 1962. 18p.

For presentation at the International Atomic Energy Agency Symposium on Reactor Safety Hazards Evaluation Techniques, Vienna, May 14-18, 1962.

Fifty measurements of the dilution rate factor, K, [rate of release/ground level concentration] were made with Ar^{41} at three locations around the Chalk River reactor stack. The smallest values of K found were 7×10^4, 6×10^4, and 4.3×10^5 at distances of 1, 1.5, and 10 Km, respectively. The total deposition of tritium oxide in the winter's snowfall was measured at 32 locations around the AECL plant area. (auth)

20859 (AERE-READING-LIST-8) RADIATION PROTECTION. A Reading List for the General Reader, and for Those Considering Working with Radioisotopes. L. S. Francis, comp. (United Kingdom Atomic Energy Authority. Authority Health and Safety Branch. Radiological Protection Div., Harwell, Berks, England). Apr. 1962. 2p.

A bibliography of 25 references is presented for those considering working with radioisotopes. (N.W.R.)

20860 (AFSWP-792) EFFECT OF WINDOW GLASS IN PROTECTING MATERIALS FROM IGNITION BY THERMAL RADIATION. L. E. Downs and H. D. Bruce (Forest Products Lab., Madison, Wis.). Nov. 1, 1955. 19p. (AD-271462)

Window glass protection of combustible materials from ignition by thermal radiation in the event of nuclear weapon explosion is discussed. The critical ignition energies of 22 materials were measured by exposure to the radiation of a graphite plate at 4200°F, with and without a filter of single strength window glass. To barely ignite a material, the energy per unit area reaching the glass had to average almost twice (average factor 1.83) the energy reaching the material directly. The protective effect varied with the test material. The protection by glass could not be calculated from the spectral emittance of the source, the spectral transmittance of the glass, and the spectral absorptance of the materials tested, without taking into consideration other properties such as the diathermancy of the materials and their change of transmittance and diathermancy during the interval of irradiation. The protective effect of glass was less against fire ball radiation than against the graphite plate radiation. (auth)

20861 (AHSB(S)R-36) THE INTERPRETATION OF WOOD DENSITY MEASUREMENTS IN THE CRITICALITY CLEARANCE OF TRANSPORT CONTAINERS. D. C. Dowson, T. Murphy, R. A. O'Sullivan, and E. R. Woodcock (United Kingdom Atomic Energy Authority. Authority Health and Safety Branch, Risley, Lancs, England). Feb. 26, 1962. 8p.

A technique is described for determining the true wood density for use in radioactive material transport containers. Criticality clearance calculations require data on wood density. (J.R.D.)

20862 (ANL-6510) HAZARD SUMMARY REPORT FOR THE ARGONNE AGN-201 REACTOR. K. C. Ruzich and W. J. Sturm, eds. (International Inst. of Nuclear Science and Engineering, Argonne, Ill.). Feb. 1962. Contract W-31-109-eng-38. 37p.

Essential characteristics of the AGN-201 reactor facility are described. Information on personnel responsibilities and requirements is included along with an evaluation of reactor safety. (J.R.D.)

20863 (BAW-1215(and Suppl.1)) SPECTRAL SHIFT CONTROL REACTOR, BASIC PHYSICS PROGRAM. EXPONENTIAL EXPERIMENT—HAZARD EVALUATION. John Funderburg (Babcock and Wilcox Co. Critical Experiment Lab., Lynchburg, Va.). Dec. 1960. Contract AT(30-1)-2602. 102p.

The hazards associated with the cold exponential experiments, scheduled to begin Jan. 1, 1961, are discussed. The experiments, facilities, and operating procedures of the basic physics studies are described. The hazards of routine operation and under unusual conditions and the credible accidents are discussed. In the supplement, the stresses in the core tanks and structural supports are summarized, an operating procedure is given for preventing LSR table closure with all the control rods withdrawn from the core, and the effective dose from the maximum credible accident is calculated for the perimeter of the exclusion area closest to the site. (D.L.C.)

20864 (DASA-1242) MORTALITY IN SMALL ANIMALS EXPOSED IN A SHOCK TUBE TO "SHARP"-RISING OVERPRESSURES OF 3-4 MSEC DURATION. Technical Progress Report. D. R. Richmond, V. C. Goldizen, V. R. Clare, D. R. Pratt, F. Sherping, R. T. Sanchez, C. C. Fischer, and C. S. White (Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex.). June 15, 1961. Contract DA-49-146-XZ-055. 73p.

A total of 661 animals was exposed to "sharp"-rising overpressures of 3 to 4 msec duration using a shock tube of novel design which produced a pressure pulse similar to that obtained with high explosives. The reflected shock overpressures associated with 50% lethality were 29.0, 38.6, 35.2 and 35.6 psi for the mouse, rat, guinea pig and rabbit, respectively. Other observations included the time of death in mortally wounded animals and gross pathological lesions likely to contribute to mortality. Selected data from the literature bearing upon the influence of overpressure and pulse duration on lethality were reviewed. These included pulse durations ranging from less than 1 msec to 8 sec. The critical pulse duration, that duration shorter than which the overpressures required for mortality increases sharply, was noted to depend upon animal size and to be of the order of many hundreds of microseconds to very few milliseconds for "smaller" animals and a few to many tens of milliseconds for "larger" animals. (auth)

20865 (DPR/INF/266) THE EVALUATION OF POWER REACTOR SITES. F. R. Farmer (United Kingdom Atomic Energy Authority. Authority Health and Safety Branch, Risley, Lancs, England). Apr. 1962. 8p.

The probable amounts of fission products released to the atmosphere in a serious reactor accident are given. Classifications of wind conditions are given for eight different locations. Time-integrated fission product concentrations are also given. The limits of the distances taken in deriving the site rating from the population are discussed. (D.L.C.)

20866 (DXRL-AR/12) ANNUAL REPORT FOR THE YEAR 1961 [ON RADIOLOGICAL ACTIVITIES]. (New Zealand. Dominion X-Ray and Radium Lab., Christchurch). 24p.

Services provided by the laboratory to radiation source possessors are reported along with developmental work. Included are sections on field services, laboratory services, and special projects on various radiation measurements. (J.R.D.)

20867 (HW-70351(Rev.)) NUCLEAR SAFETY SPECIFICATION BASIS FOR HANFORD 0.95 PER CENT U-235 ENRICHED, I AND E FUEL ELEMENTS. C. L. Brown (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Nov. 15, 1961. Contract [AT(45-1)-1350]. 5p.

Safe criticality limits for I & E fuel elements are presented. These values may be used as the basis for revisions in plant nuclear safety specifications. Also included are nuclear safety bases for U scrap and K uranium billets. (J.R.D.)

20868 (HW-71999) EVALUATION OF RADIOLOGICAL CONDITIONS IN THE VICINITY OF HANFORD FOR 1961. R. F. Foster—I. C. Nelson, ed. (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Mar. 1, 1962. Contract AT(45-1)-1350. 255p.

An evaluation of results obtained from the Hanford environmental surveillance program for 1961 indicates that most of the environmental radiation exposure for the majority of persons in the neighborhood of the Hanford project was due to natural sources and world-wide fall-out rather than to Hanford operations. The principal Hanford source of environmental exposure continues to be identified with the neutron-induced radionuclides present in reactor cooling water discharged to the Columbia River. The primary mechanisms of exposure from this source are the drinking of sanitary water derived from the river and the consumption of fish and waterfowl which inhabit the river. For the residents of Pasco and Kennewick, a potential exposure from municipal drinking water was estimated as about 5% and 1%, respectively, of the nationally recommended limit for the gastrointestinal tract as the limiting body organ. For the ardent fisherman who consumed 10 pounds of local fish in 1961, a potential exposure from bone-seedking radionuclides was estimated to be about 25% of the appropriate limit. Samples of 1500 ducks bagged by hunters in southeastern Washington were analyzed. The bird having the largest amount of radioactive material of Hanford origin would have provided, when ingested, approximately 10% of the recommended limit for bone. The average bird would have provided less than 0.5% of the limit. The dose to the thyroid gland from ingestion of I^{131} in milk (exclusive of fall-out), consumed at a rate of one quart per day, was within applicable limits. The composite annual exposures, exclusive of those contributed by recent fall-out, were similar to those reported for 1960, but trends in several Hanford sources were downward late in the year. Additional pretreatment of the reactor cooling water is credited with these reductions in exposure sources. (auth)

20869 (NP-11653) HARDENING—OPTIMUM BLAST PROTECTION FOR MINIMUM COST. Technical Study No. 29. W. J. Christensen (Bureau of Yards and Docks). May 1962. 10p.

A method is presented of assisting in the choice of a design for overpressure which gives maximum survival probability. The method is applicable to various types of relatively shallow buried cut-and-cover structures subjected to potential air blast damage by direct attack with nuclear weapons. It is noted that the method should not be used as a rigid criteria. (J.R.D.)

20870 (NYO-9934(Vol.III)Ext.) STRONTIUM-90 ASSAY OF VARIOUS ENVIRONMENTAL MATERIALS. R. S. Hirshman and Arthur R. Schulert. Sr^{90} IN CERTAIN DIETS IN SOUTH AMERICA AND SOUTHEAST ASIA 1959-60. Arthur R. Schulert (Columbia Univ., Palisades, N. Y. Lamont Geological Observatory. Geochemistry Lab.). [Oct. 1961]. Contract [AT(30-1)-1656]. 30p.

Radiochemical procedures are given for assay of Sr^{90} in air, water, bone, milk, vegetation, excreta, and soil. The information is presented in sections concerning radiochemical procedures, radiometric measurement, and discussion of representative data on reproducibility and other problems. (J.R.D.)

20871 (PAN-269/I-A) ISSLEDOVANIE RADIOAKTIVNOSTI SHLAKOV PRIMENYAEMYKH V PROIZVODSTVE STROITEL'NYKH MATERIALOV. (Measurements of the Radioactivity of Slags Used in the Production of Building Materials). M. Dakowski (Dakovski), J. Kownacki (Ya. Kovnatski), H. Lancman (G. Lantsman), and Z. Wilhelmi (Vil'gel'mi) (Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw). 1961. 17p.

Measurements of β, γ, and α radioactivity of slag samples obtained from several Polish factories were undertaken. From these measurements it was concluded that the amount of activity contained in these slags is not dangerous for people and animals staying in buildings made of these materials. (auth)

20872 (PNE-128F) SUMMARY OF PREDICTIONS AND COMPARISON OF OBSERVED EFFECTS OF GNOME

ON PUBLIC SAFETY. Final Report. (Beers (Roland F.), Inc., Alexandria, Va.). Apr. 13, 1962. Project GNOME. Contract [AT(29-2)-1163]. 16p.

Measurements of ground motion made in connection with Project Gnome are reviewed. The amplitudes of ground motion predicted within a homogeneous body of salt (halite), as a semi-infinite medium, showed good agreement with measurements. The procedures used to reach these predictions were evaluated. (M.C.G.)

20873 (PNE-133F) ON-SITE RAD-SAFE REPORT, MARCH 1962. (Reynolds Electrical and Engineering Co., Inc. Radiological Safety Div., Mercury, Nev.). Project GNOME. Contract [AT(29-2)-162]. 24p.

On-site radiological safety support in Project Gnome is described. The purpose of this support was to assist in exclusion area control, to minimize the radiation exposure of participating personnel and observers, and to prevent the spread of radioactive contamination. The program included all phases of industrial hygiene, radiation safety, and contamination control. Equipment, facilities, personnel, and services are described. (M.C.G.)

20874 (SC-4673(RR)) A NEW APPROACH TO CLEANROOM DESIGN. W. J. Whitfield (Sandia Corp., Albuquerque, N. Mex.). Mar. 1962. Reprinted May 1962. Contract [AT(29-1)-789]. 28p.

An experimental cleanroom is described which eliminates the need for strict personnel control, special clothing, and special operational procedures. Tests showed that cleanliness levels were achieved which are several orders of magnitude better than cleanrooms of conventional design. General design features, and the results of operational tests, are also described. (auth)

20875 (UCRL-6818) HAZARDS CONTROL. Quarterly Report No. 7, October–December 1961. (California. Univ., Livermore. Lawrence Radiation Lab.). Contract W-7405-eng-48. 24p.

Hazards control is described. Topics covered include: respiratory protective equipment, application of solid state plutonium air monitor in stack monitoring, radioactive gas monitoring systems, thin plastic scintillators for continuous beta air monitoring, pitot tubes for air-flow balancing operations, venturi-type calibrator for high-volume air samplers, flooring research and development, portable air sampling device operated by compressed air, radio communicator for face masks, hose rollers, hose bins, capacitor discharge in freon atmosphere, and fire fighter for two-man operation. (M.C.G.)

20876 (UR-605) THORIUM INHALATION STUDIES. Bruce B. Boecker (Rochester, N. Y. Univ. Atomic Energy Project). Nov. 29, 1961. Contract W-7401-eng-49. 278p.

The distribution and excretion of thorium following inhalation of thorium chloride were investigated with emphasis on the effect of the size of the initial lung thorium burdens. Experimental procedures included whole-body counting, excretion collection, and serial sacrifice over periods of 4 to 90 days post-exposure. Soon after exposure, a fraction of the thorium in the lungs was absorbed into the body and the largest portion of this absorbed fraction was deposited in the skeleton. Following this initial uptake, the organ thorium burdens remained approximately constant or decreased with time after exposure. The remaining lung burden decreased with time after exposure accompanied by excretion of thorium predominately in the feces. The fraction of the thorium lung burden that was absorbed and the fractions excreted in the urine and feces did not appear to be affected by a variation in the size of the initial lung burden by a factor of 1.1×10^5. Median values for the skeletal thorium burden varied from 4 to 25% of the initial lung burden with 90% of the values being less than 20%. Rats exposed 1 to 5 times to thorium chloride aerosols also had skeletal thorium burdens proportional to the total exposure. A comparison exposure was made with a thorium citrate complex aerosol and the above results were also compared with published results for the inhalation of plutonium nitrate aerosols. (auth)

20877 (Y-1386) A COMPUTER PROGRAM FOR DETERMINING FIRST COLLISION NEUTRON DOSES. C. S. McMurray (Union Carbide Nuclear Co. Y-12 Plant, Oak Ridge, Tenn.). Aug. 21, 1961. Contract W-7405-eng-26. 40p.

A data processing program was written to compute the neutron dose received by individuals exposed in a nuclear excursion. Data for the computation were obtained from the analysis of personal dosimeter badges, blood samples, and area threshold detector components. The formulas employed are based on threshold detector dosimetry studies conducted by the Oak Ridge National Laboratory. The program computes doses for each individual and dosimeter station for every combination of available data. Diagnostic logic is employed to test each entry of data. The program is written in Fortran for processing data in the IBM 7090 computer. (auth)

20878 (AECL-1498) MEASUREMENT OF LOW ACTIVITIES IN WATER. Jarmila Ralkova. Translated from Jaderná energie, 7: 374-7(1961). 6p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 16, abstract no. 7778.

20879 (NP-tr-904) THE STATUS OF PRACTICAL FILM DOSIMETRY. K. Becker. Translated by H. Schiff (U.K.A.E.A. Atomic Energy Research Establishment, Harwell, Berks, Eng.) from Kerntechnik, 3: 120-6(1961). 26p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 15, abstract no. 17163.

20880 (CEA-tr-R-1572) PROCEDE POUR DETERMINER LA DOSE DE RAYONNEMENT–γ. (Procedure for Determination of γ-Radiation Dosage). G. Z. Gochaliev and Ts. I. Zalkind. Translated into French by B. De Trezvinsky from U.S.S.R. Patent No. 136,827. 7p.

A procedure for the determination of γ dose is presented. The method is based on the velocity of the formation of hydrogen during radiology of aqueous solutions of oxalic acid in sulfuric acid. The determination is made by electrochemical techniques, and the dose is estimated according to the magnitude of the intensity of the oxidation current of the hydrogen formed. (tr-auth)

20881 DISTRIBUTION AND LEAKAGE OF GAMMA-RAYS IN THE HOT LABORATORY OF RADIATION CENTER OF OSAKA PREFECTURE. T. Azuma, J. Furuta, Y. Masuda, et al. Ann. Rept. Radiation Center Osaka Prefect., 2: 56-63(1961). (In English)

The three hot caves designed for operating 10-kc, 5-kc, and 100-c Co^{60} sources are described. The gamma flux distributions in these caves and leakages from them were determined with a 3.8-kc source in the cave designed for 10 kc, a 1-kc source in the cave for 5 kc, and a 10-c source in the cave for 100 c. The dose rate above the roof of the hot laboratory was also measured. (D.L.C.)

20882 RADIATION TOLERANCE CRITERIA IN SPACE OPERATIONS. Hermann J. Schaefer (U. S. Naval School of Aviation Medicine, Pensacola, Fla.). ARS (Am. Rocket Soc.) J., 32: 771-3(May 1962).

Discussion is given on a realistic balance of hazards to

man from various causes in space flight. It is felt that this calls for substantially higher dose levels of permissible and emergency exposure to ionizing radiation than those set forth in existing official regulations. Because of the time factor and recovery phenomenon, the instantaneous net injury is always smaller than the accumulated gross exposure. A tentative model for the extrapolation of available animal data to man is suggested using a recovery half time of 25 days and a nonrecoverable fraction of injury of 22%. Implications for emergency exposure levels are also discussed. (P.C.H.)

20883 QUANTITATIVE DETERMINATION OF FISSION PRODUCTS IN SAMPLES FROM THE NORTHERN ALPS AND GLACIERS IN THE YEAR 1960. V. Gazert, K. Poetzl, and R. Reiter (Physikalisch-Bioklimatische Forschungsstelle, Munich). Atomkernenergie, 7: 106-11(Mar. 1962). (In German)

The most important fission product elements (Ce^{144} + Pr^{144}, Sr^{90} + Y^{90}, Cs^{137} + Ba^{137}) were obtained separately and determined quantitatively by means of a chemical separation (new method) and subsequent β-radioactivity measurements in the following subtances: (1) Total of all the precipitation samples of the valley station Farchant (F) (675 m.a.s.l.) in 1960. (2) The same from the peak station Wank (W) (1780 m.a.s.l.) in 1960. (3) Total of all the grass samples (ashes) of F in 1960. (4) The same from W in 1960. (5) The same from the "Gatterl" (G) (2200 m.a.s.l.; boundary of continuous vegetation) in 1960. (6) The same from Spitsbergen (S) (0–500 m.a.s.l.) in July and August 1960. (7) Total of all the glacier surface samples from the "Zugspitzplatt" (Z) (2650 m.a.s.l.) in summer and fall 1960. (8) The same from S (0 to 500 m.a.s.l.) in July and August 1960. F, W, G, and Z are situated in the Northern Alps near Garmisch-Partenkirchen. A comparison of the results with the previously published data of 1959 shows a more or less strong decrease of all the fission product elements examined (exceptions: Sr^{90} in grass at F and G). The average radioactivity in precipitation was larger at F than at W, which is due to wash-out, also of raised dust, but the difference was smaller than in 1959. The artificial radioactivity of grass is found to increase with the altitude a.s.l. in the Northern Alps, and to be larger in S (0 to 500 m.a.s.l.) than in the Northern Alps at 2200 m.a.s.l.; hence it is concluded that it is influenced by the winter duration, i.e., by the amount of fall-out accumulated in winter on the snow, which then melts at the same time as grass begins to grow. In 1960, the glacier surface radioactivity in S is about the same as at Z, which means that the amount of all the fall-out deposited per square unit on the earth's surface through the last years is the same in S (79°N) as in the Northern Alps (47°N), because in S as well as in the Northern Alps the ablation was very strong in 1960 and in the years before; hence it may be concluded that the barrier efficiency of the tropopause is about the same in both latitudes, i.e., that a pronounced tropopause must exist also in very high latitudes. (auth)

20884 SOME PROBLEMS ENCOUNTERED IN THE INVESTIGATION OF GONAD DOSES RECEIVED BY PATIENTS UNDERGOING DENTAL X-RAY EXAMINATIONS. R. W. Stanford, K. Twinn, and C. B. Allsopp (Guy's Hospital Medical School, London). Brit. J. Radiol., 35: 366-71(June 1962).

An investigation was made of the gonad doses received by patients undergoing dental x-ray examinations. Experiments were made on a water-filled phantom made of neoprene with the addition of a head. The phantom was mounted on a dummy dental chair constructed to facilitate radiation measurements. A modified casette was left in position and 100 dental exposures were made and the blackening of the film was then compared with that of calibrated films exposed to single known doses of radiation. Problems encountered in the investigation are discussed. (C.H.)

20885 EFFECT OF ORGANIC MATTER ON THE ACCUMULATION OF FISSION PRODUCTS IN CROPS. I. V. Guliakin and E. V. Yudintseva. Compost Sci., 2: No. 4, 9-12(1961).

A series of Russian experiments reveal how organic matter and lime greatly reduce the plant uptake of radioisotopes. (Publ. Health Eng. Abstr.).

20886 ORGANIC MATTER, SOIL COMPOSITION AND FISSION UPTAKE. I. V. Guliakin and A. V. Korovkina. Compost Sci., 2: No. 4, 12-13(1961).

The results of an experiment with oat and pea plants indicate that the decrease in the plant uptake of radioisotopes under the influence of organic matter was greater in sandy loam soil than in loamy soil. Hence, the addition of humus largely eliminates the difference in plant absorption of radioactive fission products from soils of differing mechanical composition. (Publ. Health Eng. Abstr.).

20887 THE ARTIFICIAL RADIOACTIVITY OF THE AIR AND OF PRECIPITATIONS. Hubert Garrigue (Observatoire du Sommet du Puy de Dôme, Orcines, France). Compt. rend., 254: 2412-13(Mar. 26, 1962). (In French)

A resumé of the results obtained at the observatory on the crest of Puy de Dôme from 1951 to 1962 on the atmospheric and precipitation radioactivity is presented. (tr-auth)

20888 RADIATION DOSE OF THE BONE MARROW IN SOME MODERN X-RAY INVESTIGATION METHODS OF HEART–CIRCULATORY SYSTEMS. L. Papagni (Istituto di Radiologia dell'Ospedale, Milan), B. Roseo, and F. Bellini. Fortschr. Gebiete Röntgenstrahlen u. Nuklearmed., 96: 75-81(Jan. 1962). (In German)

Measurements were made of the radiation dose received by the bone marrow during cardiac catheterization with prolonged screening and angiocardiograms with biplane apparatus. For this purpose a phantom resembling a human body and containing bones inside scattering material was employed. From the data obtained, the average dose and the integral dose received by the bone marrow were calculated. It was found that during cardiac catheterization without correct protection procedure the average dose received by active bone marrow exceeded that which is said to double the incidence of spontaneous leukemia (which is, according to Court Brown, 50 r). (auth)

20889 EXAMINATION OF WATER FOR RADIOACTIVITY IN SELECTING UNDERGROUND SOURCES FOR DRINKING WATER SUPPLY. I. E. Muchin. Gigiena i Sanit., 26: No. 11, 9-14(1961).

The article contains data on the concentration of radon, radium, and uranium in the water of several underground sources of 2 regions and also its total radioactivity according to β-count. On the basis of the water radioactivity investigation the author raises the question as to the obligatory examination of the water for the presence of isotopes in the choice and hygienic evaluation of water sources to be used as drinking water supply. Examinations of underground water radioactivity should be performed more widely and the results obtained added to the sanitary and hydrogeological specifications of the water sources. In the future it should be possible to delineate definite regions containing water of diverse radioactivity. (Publ. Health Eng. Abstr.).

20890 RADIATION EXPOSURE IN CHILDREN; DIAGNOSTIC STUDIES FOR CONGENITAL HEART DISEASE. Madison S. Spach and M. Paul Capp (Duke Univ., Durham, N. C.). A.M.A. J. Diseases Children, 103: 750-8(June 1962).

By means of a Pressedwood phantom with the average dimensions of a 4-year-old child and an ionization chamber, dosimetry measurements were made for the following pediatric radiologic examinations: routine chest roentgenograms, conventional fluoroscopy, image intensification, image intensification with television, cineradiography, and biplanar angiocardiography. The skin exposure for these procedures is tabulated and discussed in relation to previous data. The total skin dosage required for all of these procedures was found to be lower than the reported values of 136 and 60 r; it varied from 25 to 47 r for 5 procedures. Conventional fluoroscopy required the highest dose (21 r) in cardiac catheterization techniques. The following factors are recommended for keeping exposure of children to a minimum: (1) use of the long-scale contrast technique with adequate filtration for routine roentgenograms, (2) use of the smallest possible shutter opening and gonadal shielding, (3) elimination of fluoroscopy as a routine office procedure, (4) use of machines with an output of <5 r per min for pediatric practice, (5) inspection of fluoroscopes every 6 to 12 months to ensure that this output is not exceeded, and (6) use of image intensifiers rather than the conventional fluoroscope, the greatest source of radiation exposure in pediatric diagnosis. (H.H.D.)

20891 "DUE CAUTION" AND RADIOIODINE IN CHILDREN (EDITORIAL). D. A. Fisher and T. C. Panos (Univ. of Arkansas, Little Rock). A.M.A. J. Diseases Children, 103: 729-37(June 1962).

Somatic and genetic effects, such as may be produced in children by the diagnostic use of I^{131}, are discussed. Survey of available data indicates that the doses routinely employed (5 to 100 μc) may be considered as potentially harmful. The risks include direct damage to thyroid cells as well as the genetic effects of concomitant gonadal radiation. Since 90% of the β radiation of I^{131} is confined to the thyroid 24–48 hr after injection of the tracer, the major concern is thyroid carcinogenesis. The evidence indicates that even isotope doses as low as 1 μc, which may be used with sensitive detection equipment for evaluation of thyroid function, may be sufficient to induce thyroid carcinoma, whereas doses of 0.05–0.2 μc, which are possible with specially adapted counters, may not involve a significant risk. Also, this low dose would not appear to carry genetic risks. It is concluded that: (1) I^{131} should not be used in pediatrics unless the required diagnostic information can not be obtained by other means, (2) I^{131} should be used only when results of the tests can be interpreted accurately, and (3) low doses and highly sensitive detectors should be used. (H.H.D.)

20892 RADIATION HAZARDS IN RADIODIAGNOSIS. M. M. Ragab and A. Z. Hanna (Cairo Univ.). J. Egypt. Med. Assoc., 44: 538-53(1961).

A review is presented. (H.H.D.)

20893 HAZARDS TO HEALTH IN URANIUM MINING AND MILLING. Victor E. Archer, Harold J. Magnuson, Duncan A. Holaday, and Pope A. Lawrence. J. Occupational Med., 4: 55-60(Feb. 1962).

Uranium miners in the Colorado Plateau have been under epidemiologic surveillance since 1950. During this time the working population has increased from approximately 350 to nearly 6,000. Deaths in a study group of 3,317 miners, followed 2 to 9 years between 1950 and 1959, with 13,270 person-years of observation, have been analyzed by the life-table technique. Preliminary calculations applied to a cohort of 907 white miners with 3 years or more of uranium mining experience show 5 lung cancer deaths to have occurred where 1.1 was expected; 8 deaths from heart disease other than arteriosclerotic where 0.4 was expected; and 10 deaths from non-motor-vehicle accidents where 2.5 were expected. All of these differences are interpreted as significant at the 95% confidence level. Concurrent environmental surveys of uranium mines have shown a high proportion of operating mines with concentrations of radon daughter products above the recommended working level of 1.3×10^5 Mev of potential alpha energy per liter of air. A continuing program of education and promotion of improved environmental control is being accelerated. (Publ. Health Eng. Abstr.).

20894 PROTECTIVE MEASURES AGAINST THE EFFECTS OF RADIATION FROM RADIOACTIVE MATERIALS USED IN INDUSTRY. Wolfgang Schwarzer. Kerntechnik, 4: 56-9(Feb. 1962). (In German)

Protective measures against external radiation hazards are described, and practical examples, in connection with sealed sources, are given. The special protective measures taken against air and water contamination are also explained. An example shows how the required protective measures can be derived and calculated for a special case. (auth)

20895 SKIN DECONTAMINATION IN PRESENCE OF THALLIUM-204. M. H. Faes (Centre d'Étude de l'Énergie Nucléaire, Mol, Belgium). Nature, 194: 1188-9(June 23, 1962).

Decontamination tests on rat skins contaminated with Tl^{204} sulfate solution were conducted with three decontaminating solutions: soap, sodium ethylenediamine tetraacetic acid, and calcium ethylenediamine tetraacetic acid. The results indicate that a solution of water and soap is the most efficient agent. A device is described for continuous-flow decontamination with minimum rubbing, time, and spreading of contaminant. (D.L.C.)

20896 CLEANING, PACKING AND TRANSPORTATION OF NUCLEAR PRODUCTS AND COMPONENTS. R. J. Garland. Nuclear Energy, 232-7(June 1962).

Methods used to secure freedom of nuclear materials and surroundings from contamination are considered and correlated. Topics discussed include types of contamination, composition of cleaners, liquid cleaning, grit blasting, clean room assembly, cleaning of large components, cell types, remote handling, active materials handling, decontamination facilities, active materials packaging, shielding by space, and isotope transportation. (M.C.G.)

20897 HANDLING RADIOACTIVE MATERIALS. Nuclear Eng., 7: 224-38(June 1962).

The techniques and equipment for handling radioactive materials in experimental facilities are described. Designs and characteristics are given for remote-controlled tongs and manipulators, glove box instruments, irradiation facilities, and a remote-controlled welding and cutting machine. Equipment specifications indicate manufacturer, model, capacity, movement, and other characteristics. (N.W.R.)

20898 PRESENT-DAY ASSESSMENTS OF RADIATION HAZARDS. Bo Lindell (Radiofysiska Institutionen, Stockholm). Phys. in Med. Biol., 6: 173-98(Oct. 1961).

Present-day knowledge of the biological effects of ionizing radiation are reviewed together with available information on current levels of exposure. Although our experience

has increased over the last few years, it is still not possible to answer the question whether low doses of radiation do in fact produce any harmful effects. On the other hand, the maximum risk of such effects occurring can be assessed, and it is evident that the number of persons affected will not be sufficiently high to be statistically detectable in any exposed group unless the dose substantially exceeds the limits at present recommended as permissible. Special emphasis is given to a survey of the data which are usually taken as the basis for assessment of the risk of radiation-induced somatic effects. The review of present radiation levels includes medical and occupational exposure as well as environmental contamination. The mechanism of fall-out of fission products from nuclear test explosions and the subsequent transport of these products through the food-chains to the human body is now essentially better understood than was the case a few years ago. (auth)

20899 AVAILABILITY TO MAN OF STRONTIUM IN COW'S MILK. T. E. F. Carr, G. E. Harrison, and Alice Sutton (M.R.C. Radiobiological Research Unit, Harwell, Berks, Eng.). Proc. Soc. Exptl. Biol. Med., 110: 151-4 (May 1962).

A double tracer method was used to measure the availability of strontium in cow's milk. Thus, strontium-87m as a dilute aqueous solution of strontium chloride was added to milk from a cow which had received strontium-85 intravenously. Urines were collected from 6 adult volunteers after ingestion of this milk mixture. It is shown that the availability of strontium in the milk is equal to that of strontium as chloride in dilute aqueous solution. The consequences of the result upon the specific activity of strontium-90 from fall-out in certain body pools are discussed. (auth)

20900 A CONTRIBUTION TO THE DISCUSSION CONCERNING RADIATION MEASUREMENTS IN MEDICAL RADIOLOGY. Hans R. Schinz and Rolf Wideroee (Kanton Hospital, Zurich). Strahlentherapie, 118: 35-41(May 1962). (In German)

The measurement of a radiation field (radiometry) must be separated from the measurement of a dose field to a body (dosimetry) in radiation measurements. Therefore, the absorption of the radiation in the air is neglected by definition and the phenomenon of the dose is used only for absorbing solid and fluid bodies. In radiometry the practical unit of the radiation density is the roentgen and the radiation intensity (r/h), respectively. In dosimetry the unit is the rad, the roentgen unit is not used. The measurement unit ρ is an auxiliary unit which is used for ionization measurements according to Bragg-Gray-Principle. The rad values can be calculated using this measurement. In dosimetry it is measured in rho (ρ) and dosed in rad. The close relationship of both tasks in radiation protection measurements is shown using one example. (auth)

20901 DETERMINATION OF LOW-LEVEL RADIOACTIVITY IN WATER. Werner N. Grune. Water & Sewage Works, 108: 472-73(Dec. 1961).

These studies were to develop a rapid and reproducible method for determining the gross alpha, beta, and gamma radioactivity in water. There is presently no instrument capable of measuring activity approaching 10^{-6} μc/ml in water. The studies were, therefore, conducted with concentrated water samples. (Publ. Health Eng. Abstr.).

20902 CODE OF PRACTICE AGAINST RADIATION HAZARDS. Third Edition. Revised June 1960. London, Imperial College of Science and Technology. 39p.

A code is presented which gives the rules applicable to the use of equipment producing x rays, to particle accelerators, and to the use of sealed and unsealed radioisotopes. The code consists of two parts, the first part dealing mainly with administrative procedure and control and the second part being a number of appendices giving detailed information and advice on practice. (D.L.C.)

20903 DOZIMETRICHESKII I SPETSIAL'NYI TEKHNOLOGICHESKII KONTROL NA ATOMNOI ELEKTROSTANTSII. (Dosimetric and Special Technological Rules for Nuclear Power Plants). P. A. Zabelin. Moscow, State Publishing House of Literature on Power, 1961. 242p.

Discussions are given on the reactions of radiation with materials, calculations for radiation protection, maximum permissible doses, and methods for measuring radiation levels. The principles of construction and operation of dosimetric devices and dosimetric control systems, and dosimetry and protection rules for nuclear power plants are also discussed. The book is designed for personnel working at nuclear power plants and for engineers and technicians handling radioactive isotopes. (R.V.J.)

20904 A MANUAL OF RADIOACTIVITY PROCEDURES. Recommendations of the National Committee on Radiation Protection and Measurements. NCRP Report No. 28. National Bureau of Standards Handbook 80. Handbooks of the National Bureau of Standards. (National Bureau of Standards, Washington, D. C.). Nov. 20, 1961. 166p. $0.50(GPO).

A survey was made of the practice of radioactivity measurement with special reference to clinical and biological applications. Procedures, instrumentation, and interpretation of results of radioactivity assays are discussed. The standardization of radiation sources and the disposal of radioactive wastes are also considered. 327 references. (C.H.)

20905 RADIOLOGICAL HEALTH DATA MONTHLY REPORT, VOLUME III, NUMBER 2. (Public Health Service, Washington, D. C.). Feb. 1962. 40p. $0.50(GPO).

Data are tabulated on radioactivity in samples of air, milk, milk products, and water collected at various stations throughout the United States and Canada during sampling periods in 1961. The ingestion of radioactivity in food was measured by sampling the diet at a number of institutions and of persons under age 18 in various geographic regions. Data are presented on global integrals of Sr^{90} in fall-out from Jan. 1958 to Dec. 1960 and the environmental levels of radioactivity for Hanford Atomic Products Operation for the third and fourth quarters of 1960 and the first and second quarters of 1961 and for the Portsmouth Area Gaseous Diffusion Plant and Savannah River Plant for the first and second quarters of 1961. Information is summarized on nuclear test detonations announced through Jan. 1962. (C.H.)

20906 RADIOLOGICAL HEALTH DATA QUARTERLY REPORT, VOLUME III, NUMBER 4. (Public Health Service, Washington, D. C.). Apr. 1962. 33p. $0.50(GPO).

Data are tabulated on radioactivity in samples of air, food, milk, and water collected at various stations throughout the U. S. in 1961. Data are included on radioactivity in various raw and processed foods sampled during 1961. A tabulation is presented of Atomic Energy Commission by-product material licensees giving locations and types of licensees as of Dec. 1961. Summaries are included of environmental radioactivity data for Bettis Atomic Power Laboratory and Shippingport Atomic Power Plant for the first and second quarters of 1961. Data are included on the location, yield, and type of test of nuclear test detonations reported during March 1962. (C.H.)

20907 RADIOLOGICAL HEALTH DATA MONTHLY REPORT, VOLUME III, NUMBER 5. (Public Health Service, Washington, D. C.). May 1962. 37p. $0.50(GPO).

Data are tabulated on radioactivity in samples of air, milk, and water collected at various stations throughout the U. S. and Canada during 1961 and 1962. Considerations in establishing radiation protection standards for radioactivity in the environment are discussed. Data are included on environmental levels of radioactivity at Argonne National Laboratory and the Rocky Flats Plant during the third and fourth quarters of 1961 and the Nevada Test Site in March 1962. Information is summarized on nuclear detonations through April 30, 1962. (C.H.)

20908 THE EFFECTS OF NUCLEAR WEAPONS. Revised Edition. Samuel Glasstone, ed. (Defense Atomic Support Agency, Washington, D. C.). 1962. 742p. $3.00 (GPO).

The effects of nuclear weapons are discussed. Topics covered include: general principles of nuclear explosions, descriptions of nuclear explosions, air blast phenomena, air blast loading and target response, structural damage from air blast, effects of surface and subsurface bursts, thermal radiation and its effects, initial nuclear radiation, residual nuclear radiation and fallout, radio and radar effects, effects on personnel, and principles of protection. (M.C.G.)

INDUSTRIAL APPLICATIONS OF ISOTOPES AND RADIATIONS

Refer also to abstract 20586.

20909 (TID-15034) RADIOISOTOPE PRODUCT DATING. ISOTOPIC METHOD OF AGE DETERMINATION OF INDUSTRIAL PRODUCTS. T. C. Gregson and W. R. Miller (Goodyear Tire and Rubber Co., Akron, Ohio). Aug. 1, 1961. Contract AT(11-1)-719. 122p.

Results of a study are presented which was undertaken to devise, develop, and demonstrate methods of isotopic dating applicable to the precise age measurement of diverse industrial products. A general method for time measurement is proposed which appears to have broad ramifications and many possible applications. (J.R.D.)

20910 (CEA-tr-A-1052) UTILISATION DE GAZ RADIOACTIFS POUR LE REPERAGE PRECIS DES DEFAUTS DANS LES GAINES DE CABLES DE TELECOMMUNICATIONS. (Use of Radioactive Gas for the Precise Marking of Defects in Telecommunication Cable Sheaths). G. Tidau. Translated into French from Atompraxis, 5: 26-7(1959). 5p.

A high percentage of the faults causing interruption in the operation of telephone service is caused by leaks in the cable installation (faults in the lead sheath, leaks at connection joints, and deficient sealer mountings). The Siemens and Halske system for the control of leaks by maintaining the interior of the cable at a pressure of 0.7 to 1.0 kg/cm^2 permits a leak to be detected before service interruption by the drop in pressure. The use of radon permits the leak to be located within surface area of 1 m^2 of soil. (J.S.R.)

20911 INDUSTRIAL RADIOGRAPHY. F. L. Bett (Australian Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales). Atomic Energy, 5: No. 2, 2-9(Apr. 1962).

The principles of radiography and its uses in industry are discussed. Radiographic technique and the interpretation of radiographs are described. (M.C.G.)

20912 SOME APPLICATIONS OF RADIOISOTOPES IN INSTRUMENT ENGINEERING. J. R. Rhodes (United Kingdom Atomic Energy Authority, Wantage, Eng.). Instr. Pract., 16: 559-67(May 1962).

Tracer applications in industrial process control are discussed. In particular, some uses of radioisotopes in mixing efficiency and bulk flow measurements of liquids and slurries, liquid and gas flow rate determination and leak detection are described. Radioactivation analysis is also mentioned. Instrumentation of radioisotope methods and applications of radioisotope instruments are discussed. (M.C.G.)

20913 SMALL RADIOISOTOPE DISPLACEMENT TRANSDUCERS. L. F. Atkinson and R. F. Knudsen (Vauxhall Motors Ltd., Luton, Beds., Eng.). Intern. J. Appl. Radiation and Isotopes, 13: 100-1(Feb. 1962). (In English)

The possibilities of using radioisotopes as a means of indicating very small displacements were explored. By modulation of the radiations from a beta source, it was possible to produce a similarly modulated secondary emission which will convey information through surrounding material. Seven types of transducers were tried. Results indicated that the system may have practical applications for static measurements. (M.C.G.)

20914 RADIATION STERILIZATION OF FOOD. II. SOME ASPECTS OF THE GROWTH SPORULATION, AND RADIATION RESISTANCE OF SPORES OF CLOSTRIDIUM BOTULINUM, TYPE. E. C. F. Schmidt, W. K. Nank, and R. V. Lechowich. J. Food Sci., 27: 77-84(Jan.-Feb. 1962).

The radiation resistance of spores of 6 strains of Type E Clostridium botulinum was determined in a beef stew substrate. The results are evaluated in terms of the minimum dose showing no spoilage for a 2 billion total inoculum level (20 cans each with 100 million spores per can) and in terms of a calculated radiation D value. The mean radiation D value for 6 strains is 0.132 megarad (range 0.125 to 0.138). A comparison with results for 6 strains of Type A and 5 strains of Type B shows that Type E strains possess about 45 to 55% of the resistance to ionizing radiations of Types A and B. It is concluded that any radiation dose for food sterilization based upon the maximum resistance of Type A or B strains would provide ample protection against Type E strains. The unswelled cans at the lowest radiation level showing no spoilage were free of toxin and recoverable Type E spores. (Publ. Health Eng. Abstr.).

20915 TREATMENT OF MEATS WITH IONISING RADIATIONS. IX. INACTIVATION OF LIVER AUTOLYTIC ENZYMES. D. N. Rhodes and C. Meegungwan (Low Temperature Research Station, Cambridge, Eng.). J. Sci. Food Agr., 13: No. 5, 279-82(May 1962).

The irradiation of liver slices with 2 Mev electrons at 0° had no effect upon the phospholipase or lipase activity of the tissue at doses less than 6 Mrad. Proteolytic activity was reduced at doses as low as 0.1 Mrad and was 50% inhibited at 3.0 Mrad. Considerable proteolytic and lipolytic activity remained after irradiation with 40 Mrad. (auth)

20916 UTILIZATION OF RADIOACTIVE ISOTOPES FOR INVESTIGATION OF MECHANICAL ENGINEERING PROBLEMS. K. Kollmann and D. Stegemann (Technische Hochschule, Karlsruhe, Ger.). Kerntechnik, 4: 41-4(Feb. 1962). (In German)

Possible applications of radioisotopes for various types of measurement are illustrated as examples of their utilization in mechanical engineering. Procedural problems are emphasized. A method for wear measurements is described, and its advantages over conventional methods of wear measurement are illustrated by test results on piston rings and slide bearings. A description is also given of a method for examining the rotary motion of a piston ring in an engine with a closed radiator. A test for determining the thickness of oil films is given in conclusion, with a special discussion of possible interferences. (tr-auth)

20917 RADIOISOTOPE METHODS FOR MEASURING WEIGHT OF CONTENTS OF ASSEMBLED ITEMS. Sigmund Berk (U. S. Army Ordnance Arsenal, Frankford, Philadelphia). Nondestructive Testing, 20: 177-9; 194 (May-June 1962).

A number of radioisotope methods for measuring the weight of primer compositions in assembled primer cups

are described. Incorporating a radioisotope directly in the primer mix can be used for measuring pellet weight. However, the method evaluated considered best is the "internal" thickness gage in which a radioisotope is placed in the primer cup before the addition of the primer composition. After assembly the radiation transmitted was measured with a G-M counter and a single channel gamma spectrometer. Cd^{109}, Ru^{106}, Y^{90}, and P^{32} were found to be effective. The method was also found feasible to measure pellet weight within certain limits. (auth)

20918 IMPROVEMENTS IN OR RELATING TO POLYMER IRRADIATION. (to Nobel-Bozel). British Patent 899,683. June 27, 1962.

A method for processing a polymer is given which is applicable to radioinduced graft polymerizations on an industrial scale in the absence of air or oxygen. The method comprises immersing the polymer and a polymerizable monomer in a non-dissolving liquid to form a pulp, and flowing the pulp in a conduit past a radiation source. The liquid may also be a source of free radicals for accelerating the irradiation-polymerization processes, particularly water. Several examples of the method are given. (D.L.C.)

20919 METHOD OF WELL LOGGING. Leendert de Witte (to Continental Oil Co.). U. S. Patent 3,037,115. May 29, 1962.

A neutron logging method is given for determining the points of entry of different liquids in a well, especially brine and oil in oil wells. The method comprises irradiating the liquid mixture with 10-kev neutrons and detecting the reflected neutrons. An apparatus for putting this method into effect is described briefly. (D.L.C.)

20920 APPARATUS FOR IRRADIATING LIQUIDS. George Weber. U. S. Patent 3,037,116. May 29, 1962.

An apparatus for irradiating liquids comprises a plurality of compartments made of a material transparent to certain radiations and communicating with each other. The liquid to be irradiated is flowed through the compartments which are surrounded by radiation sources, e.g., u-v lamps. The apparatus is especially useful for ripening beer and for increasing the vitamin D content of milk. (D.L.C.)

20921 DISTILLATION PROCESS AND APPARATUS. Thomas F. Doumani (to Union Oil Co. of California). U. S. Patent 3,038,843. June 12, 1962.

A method is given for producing stable distillates in cases where such distillates are normally unstable, particularly hydrocarbon oils susceptible to formation of polymers, gums, color, etc. The method comprises providing sources of radiation at one or more points in the fractionation zone; the radiations selectively activate the unstable contaminants and convert them to less volatile polymers. Several ways of locating radiation sources in fractional distillation columns are described. (D.L.C.)

ISOTOPE SEPARATION

20922 (IFA/DF/15) THE DISTILLATION OF ISOTOPIC MIXTURES IN TAPERED CONDITIONS. D. Barb, R. Bucur, and A. Olariu (Academia R. P. R. Institutul de Fizică Atomică, Bucharest). 1961. 15p.

The equation of separation by distillation for binary isotopic mixtures in adiabatic conditions and with its generalization for a squared-off column is discussed. The validity of the equation for the ternary mixture H_2O-HDO-D_2O is demonstrated. Results indicated that tapered columns, when both high separation and small equipment volume are wanted, are more favorable than adiabatic operating columns. It was concluded that the procedure may be used for producing highly enriched isotopes. Relationships were derived to permit calculation of separation units in tapered conditions. (M.C.G.)

20923 (NP-11789) INTERCAMBIO ISOTÓPICO DE DEUTERIO ENTRE EL HIDROGENO Y EL AGUA EN FASE VAPOR. INFORME NO. 56. (Isotopic Exchange of Deuterium Between Hydrogen and Water in Vapor Phase. Report No. 56). Walter J. Baran and Rubén F. Cretella (Argentina. Comision Nacional de Energia Atómica, Buenos Aires). 1961.

The design is described of a device for the measurement of catalytic activities of the isotopic exchange reaction, H_2O (v) + HD ⇌ HDO (v) + H_2, and to determine experimentally the kinetics for the interpretation of the results for the optimum conditions for the reaction. (tr-auth)

20924 (TID-15054) APPLICATION OF MULTICOMPONENT CASCADE THEORY. John E. Bigelow and Gerald E. McTigue (Division of Operations Analysis and Forecasting, AEC). Nov. 1961. 26p.

A discussion is presented concerning the application of theoretical isotope separation cascades operating on a mixture of three or more isotopes. Attention is directed to stripping U^{233} from other isotopes associated with a reactor fuel such as that used in the Consolidated Edison Thorium Reactor. Theoretical considerations are presented along with cost calculations. (J.R.D.)

20925 (CEA-tr-R-1495) SEPARATION DES ISOTOPES DU CARBONE PAR LA METHODE AU BICARBONATE. (Separation of Isotopes of Carbon by Bicarbonate Method). I. A. Semiokhin (Semiokhim), G. M. Panchenkov, and Yu. (Iu.) A. Zhurov. Translated into French from Vestnik Moskov. Univ., Ser. II, 15: No. 5, 6-12(1960). 18p. (Includes original, 7p.).

Separation processes for carbon isotopes using the bicarbonate method were studied as a function of the nature and geometric shape of the packing, of the input of the potassium bicarbonate solutions in the column, and the column temperature. It was found that the separation is better on a catalyst of synthetic Al silicate of cylindrical shape than on silicate balls. Askans clay was shown to be efficient. It was found that the total separation coefficient increases when the temperature is lowered and when the input of the solution is increased up to a partial or total "clogging" of the column. It was shown that the time necessary to attain equilibrium decreases if the temperature and input of the reagents increases. At 20° and for a potassium bicarbonate flow velocity of 4 ml/min in a column 2 m high and 16 mm in diameter, with cylindrical Al silicate, the equilibrium separation is obtained in 8 hours. (tr-auth)

20926 PRODUCTION OF HEAVY WATER BY THE ELECTROLYTIC METHOD. Yuen-Kwei Tai and Yuen-Chi Hsu (National Taiwan Univ., Taipei, China). Ho Tsu K'o Hsueh, 2: No. 4, 10-18(1960). (In Chinese)

Two cell designs were tried for the production of high concentration heavy water. Iron was used as an electrode in both designs. The rectangular cell measured 38 cm × 54 cm × 24 cm and the cylindrical cell was 42 cm tall and 11 cm in diameter. The over-all current used was 150 amperes during the day and 75 amperes during the night (the current density on the electrodes was not given). The explosive hydrogen and oxygen mixture was passed through copper oxide kept at the optimum temperature for catalyzing the recombination of the gases into water. After six months of operation 20 cc each of 97% and 98% D_2O were obtained; the electrolytic separation coefficient was, throughout, approximately 5. (TTT)

20927 PROCESS FOR THE PRODUCTION OF WATER OR HYDROGEN HAVING AN INCREASED DEUTERIUM CONTENT. Erwin Willy Albert Becker. U. S. Patent 3,036,891. May 29, 1962.

The process for producing D_2O or D_2 by catalytic isotope exchange in a system of hot and cold columns with the catalyst dispersed in the water is modified so that commercial hydrogen containing N_2 and other impurities may be used without the formation of NH_3 which damages the catalyst. A transfer column operating at a temperature below 45°C is provided between the hot and cold columns with a degasifier for removing N_2 and other impurities from the water passing through the transfer column. (D.L.C.)

MATHEMATICS AND COMPUTERS

20928 (AAEC/E-87) A RELOCATABLE ASSEMBLY SYSTEM FOR THE I.B.M. 1620 COMPUTER. D. J. Richardson (Australia. Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales). Apr. 1962. 73p.

A relocatable assembler is described for use with the I.B.M. 1620 computer which permits separate assembly and testing of cross-referenced separately assembled subroutines. The concept of a "next subroutine" was introduced, and its applications to interpretive systems such as Fortran is shown. (J.R.D.)

20929 (MURA-635) THE PARMESH DYNAMICS PROGRAM-III. Jess Anderson and George Parzen (Midwestern Universities Research Assn., Madison, Wis.). Mar. 1, 1962. Contract AT(11-1)-384. 15p.

A continuation of reports MURA-629, 630, is presented which describes various different field inputs available in the PARMESH program. (auth)

20930 (ORNL-3199(Add.)) EQUIPOISE 3A. C. W. Nestor, Jr. (Oak Ridge National Lab., Tenn.). June 6, 1962. Contract W-7405-eng-26. 15p.

Equipoise 3A is a slightly expanded version of Equipoise 3. The two additions are a section of the input routine, which produces a picture of the arrangement of materials within the reactor, and a section of the output routine, which calculates first-order perturbation theory estimates of neutron lifetime and of the reactivity resulting from a unit increase in each of the group constants (D, Σ_R, Σ_a, and $\nu\Sigma_f$) in each region of the reactor. The latter output will be provided when the adjoint flux option is used; the only additional input data required are the average neutron speeds for the two groups. A FORTRAN source deck and a binary deck are on file. (auth)

20931 (ORNL-TM-167(Rev.)) OGRE-P1, A MONTE CARLO PROGRAM FOR COMPUTING GAMMA-RAY TRANSMISSION THROUGH LAMINATED SLABS. K. K. Trubey, S. K. Penny, and M. B. Emmett (Oak Ridge National Lab., Tenn.). May 23, 1962. Contract [W-7405-eng-26]. 5p.

A Monte Carlo IBM-7090 program (OGRE-P1) was written for calculation of the dose rate on one side of a slab owing to an isotropic, cosine, or collimated monoenergetic gamma radiation source on the other side of the slab. A maximum of 50 homogeneous regions are permitted. (auth)

20932 (UCRL-10110) APPLICATION OF LINEAR PROGRAMMING TO THE NUMERICAL SOLUTION OF LINEAR DIFFERENTIAL EQUATIONS (thesis). Jonathan D. Young (California. Univ., Berkeley. Lawrence Radiation Lab.). Mar. 1, 1962. Contract W-7405-Eng-48. 86p.

The linear programming procedure was applied to obtain an optimal solution to an overdetermined system of linear inequalities that are derived from the localization of the differential equation to some set of discrete points, from the prescribed conditions, and from the application of approximation formulas. The method was applied to linear ordinary differential equations and systems and to first- and second-order partial differential equations and systems in two independent variables. Extensions are suggested. Many examples illustrating the method are provided. (auth)

20933 (WAPD-TM-273) MARC — A MULTIGROUP MONTE CARLO PROGRAM FOR THE CALCULATION OF CAPTURE PROBABILITIES. E. M. Gelbard, H. B. Ondis, and J. Spanier (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). May 1962. Contract AT-11-1-GEN-14. 62p.

MARC-1 is a Monte Carlo program designed to estimate thermal absorption rates, thermal fluxes, and thermal fission rates in rectangular subregions of a two-dimensional rectangular lattice, based on a multi-thermal group model. An unusual feature of MARC-1 is its ability to solve problems based on either the ordinary multigroup transport equations or on the adjoint multigroup equations. The use of the adjoint model makes it possible to estimate the absorption rate in a very small region, or even at a point, with great accuracy. In the adjoint mode, the equations are transformed, making use of the theory of dual importance sampling to reduce the variance. (auth)

20934 (WAPD-TM-315) MO150 — A FORTRAN PROGRAM TO SOLVE THE DOUBLE P-3 EQUATIONS IN SLAB GEOMETRY. R. M. Cantwell (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). Apr. 1962. Contract AT-11-1-GEN-14. 15p.

In the FORTRAN program M0150, the double P-3 approximation is used to solve the one-velocity, one-dimensional transport equation in slab geometry. It is a FORTRAN version of the double P-3 option of the IBM-704 FLIP code. A pointwise isotropic source and anisotropic scattering up to the P-2 component is accepted in the program. (auth)

20935 (XDC-60-3-211) ISOTOPIC HISTORY TRACE, PROGRAM 431. S. K. Breslauer and F. P. Karriker (General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati). Mar. 10, 1960. Contract AT(11-1)-171. 77p.

A program is presented which traces the isotopic buildup of fission product chain members as a function of fission density, fission yield, decay rate, neutron capture rate, and time. The fuel conversion chains (Th^{232} through Pu^{240}) and the $Be^{9}(n,\alpha)Li^{6}$ conversion are also followed. Although the program traces the Th and Pu conversions, the power of the reactor is assumed to be due entirely to the fissioning of U^{235}. A minor program modification would be necessary to include U^{233} and Pu^{239} fissioning. Flexibility is maintained by retaining all the nuclear constants as input parameters to allow for easy modification in the light of newer values. A supplementary program lists the tables of data necessary for the calculation and punches them in binary form to facilitate handling and decrease machine time. To provide maximum mechanization the program provides data necessary to start all time steps after the first directly on punched cards. (auth)

20936 PRESENT STATE OF THE PRODUCTION AND MARKET OF URANIUM-235 AND HEAVY WATER. S. Villani (CISE, Milan). Energia nucleare (Milan), 9: 212-25 (Apr. 1962). (In Italian)

Due to the exuberant capacity of the AEC plants in the United States, the development of isotope separation processes for the production of uranium-235 and heavy water has come to a standstill. The situation is analyzed mostly on the basis of data and results published in the last three years. (auth)

20937 ANALYTICITY PROPERTIES OF THE MOMENTUM-SPACE VERTEX FUNCTION. W. S. Brown (Princeton Univ., N. J.). J. Math. Phys., 3: 221-35(Mar.-Apr. 1962).

The problem of finding the maximal domain of analyticity

of the momentum-space vertex function implied solely by Lorentz covariance, local commutativity, and mass spectrum with thresholds not all zero, is restated as a holomorphy envelope problem. If only one of the threshold masses is nonzero, the problem can be divided into two simpler problems. The triangle diagram suggests the holomorphy envelope of one, but only gives an upper bound on the holomorphy envelope of the other. It is shown that the boundary of the latter probably consists of the three cuts and a single quasi-analytic hypersurface with certain specified properties. If two of the threshold masses are equal and the third vanishes, an appealing conjecture suggested by the triangle diagram is shown to contradict a generalization of Jost's example. In the general case, upper and lower bounds are obtained. The Källén-Toll representation and conjecture are discussed. The relation of the first three terms in the representation of the position-space vertex function to the Mercedes diagram in perturbation theory is displayed; there is no analogous relation for the fourth term. In the single threshold case, this fourth term must account for the singularities of the momentum-space vertex function on the quasi-analytic hypersurface which bounds the holomorphy envelope. The motivation for studying the analyticity properties of vertex diagrams is discussed, and the simplest totally symmetric ones are investigated. (auth)

20938 ANALYTIC REGULARIZATION IN RELATIVISTIC QUANTUM FIELD THEORY. James McKenna (Princeton Univ., N. J.). J. Math. Phys., 3: 236-47(Mar.-Apr. 1962).

Terms of a perturbation expansion of the vacuum expectation value of the time ordered product of three scalar fields are examined in x space. These terms can be considered as the boundary values of analytic functions, where the variables include complex convergence parameters. Integral representations for these analytic functions are obtained which exhibit part of the domain of analyticity. The singular behavior as the complex convergence parameters tend to zero is discussed; removal of the singular part of these functions is equivalent to renormalization. (auth)

20939 ANALYTIC PROPERTIES OF PRODUCTS OF FIELD OPERATORS. R. F. Streater (Princeton Univ., N. J.). J. Math. Phys., 3: 256-61(Mar.-Apr. 1962).

It is shown that any function of $n-1$ four-vectors which is analytic in the forward tube, the backward tube, and some neighborhood of the Jost points has a one-valued continuation into the extended tube. The theorem is applied to products of field operators between arbitrary states. It is shown that each matrix element of the product is analytic in the envelope of holomorphy of the union of the permuted extended tubes (the domain of analyticity of the most general causal vacuum expectation value). Thus the product of field operators may be regarded as having analytic properties. (auth)

20940 ERGODICITY CONDITIONS IN QUANTUM MECHANICS AND VAN HOVE'S HAMILTONIANS. G. M. Prosperi (Università, Milan and Istituto Nazionale di Fisica Nucleare, Milan). J. Math. Phys., 3: 329-40(Mar.-Apr. 1962).

Starting from a formulation of the quantum-ergodic problem, it is proven that the ergodicity conditions are satisfied for the class of Hamiltonians for which Van Hove proved a master equation. Restrictive assumptions necessary to identify the unperturbed states of Van Hove with the states ω_{vl} of the ergodic theory were introduced. (auth)

20941 UNUSUAL EIGENVALUES OF THE ENERGY OPERATOR. Adel da Silveira (Colégio Pedro II and Núcleo de Estudos e Pesquisas Científicas do Rio de Janeiro, Estado de Guanabara). J. Math. Phys., 3: 346-9 (Mar.-Apr. 1962).

A generalization of quantum mechanics different from the theory proposed by T. E. Phipps (Phys. Rev. 118: 1653 (1960)) is considered. Difficulties connected with the commutation relations of the angular momentum components defined using the operators p_i of the fundamental equations are presented as new arguments in favor of the choice of Phipps of the Hermitian operators to be used in the generalized theory. The application of the equations proposed to the motion of a particle in a central Coulombic field of forces is considered. In the Dirac theory, the spectrum is different from the traditional one. The Heisenberg postulate is obeyed; an unusual spectrum is not a consequence of the violation of the postulate. (auth)

20942 CANONICAL AND HAMILTONIAN FORMALISM APPLIED TO THE STURM-LIOUVILLE EQUATION. M. A. Biot (Shell Development Co., New York) and I. Tolstoy (Columbia Univ., Dobbs Ferry, N. Y.). Quart. Appl. Math., 18: 163-72(July 1960).

The Sturm-Liouville equation is expressed in Hamiltonian form. A simple generating function was derived which defines a large class of canonical transformations and reduces the Sturm-Liouville equation to the solution of a first order equation with a single unknown. The method was developed with particular reference to the wave equation. Some new transformations were obtained, useful in the turning point region and for improvement of accuracy in the region of validity of W.K.B. solutions. In addition, a new power series expansion near the turning point was obtained. (auth)

20943 A NOTE CONCERNING HYPERBOLIC EQUATIONS WITH CONSTANT COEFFICIENTS. James F. Heyda (General Electric Co., Cincinnati). Quart. Appl. Math., 18: 299-300(Oct. 1960).

The canonical form of the linear, homogeneous hyperbolic partial differential equation in two independent variables is $U_{xy} + A_{ux} + bU_y + CU = 0$. The constant coefficient case can be reduced to the simpler form: $V_{xy} - \lambda V = 0$, $\lambda = Ab - c$. The solution by Copson to an equivalent form of this equation was the same as that obtained by Riemann's method. The Bessel function $I_0(2[\lambda(x-\alpha)(Y-\beta)]^{1/2})$ was identified as the Riemann characteristic function for the equation. This enabled a direct solution for the equation to be obtained for prescribed values of $V(x, y)$. (M.C.G.)

20944 ON THE SOMMERFELD HALF-PLANE PROBLEM. Bernard A. Lippmann (Univ. of California, Livermore). Quart. Appl. Math., 18: 301-3(Oct. 1960). (UCRL-5667-T)

A derivation of the Sommerfeld solution to the problem of the diffraction of a plane, scalar wave by a half-plane is given. It is felt that the ansaltz that forms the core of the argument is probably more generally applicable. (auth)

20945 SOME VARIATIONAL PRINCIPLES FOR PROBLEMS IN HYDRODYNAMIC AND HYDROMAGNETIC STABILITY. R. C. DiPrima (Rensselaer Polytechnic Inst., Troy, N. Y.). Quart. Appl. Math., 18: 375-85(Jan. 1961).

A number of problems in hydrodynamic and hydromagnetic stability give rise to characteristic value problems with differential equations of high order but with constant coefficients. It is shown that these characteristic value problems can be formulated as variational problems which can be solved exactly without the necessity of integrating any differential equation. The method of solution depends primarily on the expansion of the unknown functions in the variational principles in complete sets of appropriate orthogonal functions. It is also shown how these methods can

be extended to a non-self adjoint boundary value problem by using a variational principle dependent on both the original problem and the adjoint boundary value problem. A method of solving the characteristic value problem by a direct series substitution in the differential equation is illustrated. (M.C.G.)

20946 ADDITION THEOREMS FOR SPHERICAL WAVE FUNCTIONS. Seymour Stein (Sylvania Electronic Systems, Waltham, Mass.). Quart. Appl. Math., 19: 15-24(Apr. 1961).

Addition theorems are described for spherical vector wave functions, under both rotations and translations of the coordinate system. These functions are the characteristic solutions in spherical coordinates of the vector wave equation, such as occurs in electromagnetic problems. The vector wave function addition theorems are based on corresponding theorems for the spherical scalar wave functions. The latter are reviewed and discussed. (auth)

20947 DISCONTINUITIES IN INTEGRAL-TRANSFORM SOLUTIONS. Bruno A. Boley (Columbia Univ., New York). Quart. Appl. Math., 19: 273-84(Jan. 1962).

Criteria were derived for the determination of the magnitude and the location of discontinuities of solutions in the form of definite integrals obtained by means of integral-transform techniques. The types of integrals arising with the Fourier sine or cosine transforms and those arising with the Laplace transforms are considered. Applications of the theory arise particularly with problems of wave propagation, where interest is centered on the location of wave fronts and the magnitude of jumps there. Two illustrative examples of such problems relating to Timoshenko beams are included. (auth)

20948 STABILITY BY LIAPUNOV'S DIRECT METHOD WITH APPLICATIONS. Joseph La Salle and Solomon Lefschetz. Mathematics in Science and Engineering. A Series of Monographs and Textbooks. Volume 4. New York, Academic Press, 1961. 139p.

Geometric concepts are discussed, and differential equations are given. Applications of the theory to controls and extensions of the method are discussed. (L.N.N.)

20949 FUNDAMENTAL PROBLEMS IN STATISTICAL MECHANICS. Proceedings of the NUFFIC International Summer Course in Science at Nijerode Castle, The Netherlands, August 1961. E. G. D. Cohen, comp. Amsterdam, North-Holland Publishing Company and New York, Interscience Publishers, Inc., 1962. 256p. $7.50.

The lectures of nine men on fundamental methods and problems in statistical mechanics are presented. The information is presented primarily for the theoretical physicist. (N.W.R.)

METALS, CERAMICS, AND OTHER MATERIALS

General and Miscellaneous

Refer also to abstracts 20297 and 20532.

20950 (BM-RI-5980) USE OF RADIOACTIVE TRACERS IN BERYLLIUM EXTRACTIVE METALLURGY RESEARCH. A. M. Poston, Jr., J. V. Batty, and H. L. Gibbs (Bureau of Mines, Salt Lake City Metallurgy Research Center). May 1961. 13p.

The problems in using radioactive tracers and radiometric methods in extractive metallurgical research on beryllium are discussed. The conditions and techniques for their effective use are defined. The limitations and flexibility inherent in applying such methods in laboratory-scale beryllium research are outlined. Methods were developed for using gamma-emitting Be^{7} as a tracer in fusing, leaching, and solvent extraction steps, and gamma-emitting Fe^{59} and positron-emitting Al^{26} in the solvent extraction studies. Be^{7} and Fe^{59} proved readily usable and effective as tracers; Al^{26} was not. (M.C.G.)

20951 (CEND-149) THE DEVELOPMENT AND TESTING OF UO_2 FUEL SYSTEMS FOR WATER REACTOR APPLICATIONS. Quarterly Report, July–September 1961. B. E. Murtha and W. P. Chernock (Combustion Engineering, Inc. Nuclear Div., Windsor, Conn.). Oct. 27, 1961. Work performed under United States–Euratom Joint Research and Development Program. Contract AT(30-1)-2863. 50p. (EURAEC-208)

A series of fuel rods was vibratory compacted to 90% of theoretical density to study longitudinal density variations. Densities obtained from three-in. sections showed a decline in fuel density in the sections immediately adjacent to the end plugs. Improved loading and pre-densification techniques have reduced the total density variation to about ±1.5%. Fuel rods prepared by a combined vibratory compaction–swaging process reached theoretical densities in the range of 92 to 93% with a minimum of dimensional and density variation and excellent reproducibility. No indications of micro- or macro-cracking were found in metallographic sections of the stainless steel clad. This process appears useful for the fabrication of fuel rods when the density requirement exceeds 92% of theoretical. In addition, a combination of vibratory compaction and swaging may provide a more economical method of achieving densities in the range of 88 to 92% of theoretical. The projection welding program for fabricating fuel rod clusters will be reactivated during the month of November 1961, with the ultimate objective of fabricating a seven-foot long, 61-rod, hexagonal cluster by next June. Time-temperature annealing tests indicate that work hardened, type 347, stainless steel tubing will retain its strength properties for at least ten years at 750°F. Collapse testing was initiated to determine the actual critical external pressures which will lead to tube wall collapse on thin walled, work hardened cladding. (auth)

20952 (EURAEC-71) STUDY OF URANIUM MONOCARBIDE SHAPING AND IRRADIATION. Quarterly Progress Report No. 1, December 15, 1960 to March 14, 1961. P. Rousset (France. Commissariat a l'Energie Atomique, Centre d'Etudes Nucleaires, Saclay). Apr. 13, 1961. Work performed under United States–Euratom Joint Research and Development Program. Contract [033-60-12RDF]. 6p. A translation.

Operating conditions for sintering-extrusion of UC were established. Gas removal from powders, handling of powders, closing of vessels, and extrusion conditions are described. Plans for irradiation testing are outlined. (M.C.G.)

20953 (HW-73476) POSSIBLE ARTIFACTS ASSOCIATED WITH MICROSTRUCTURE OF URANIUM DEVELOPED BY ION BOMBARDMENT. T. K. Bierlein, B. Mastel, and R. D. Leggett (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Apr. 1962. Contract AT(45-1)-1350. 25p.

Uranium specimens etched by ion bombardment may reveal artificial or spurious microstructural detail. Possible artifacts were investigated including deposition of sputtered atoms on the surface of the sample being etched, and enlargement or distortion of pores intersecting the surface of the sample being etched. The number and size of hillocks formed on a U surface during etching at four conditions which differ only with respect to the value of Kr gas pressure and etching period was determined. For conditions of high gas pressure and long etching period, many more hillocks are produced than for low gas pressure and short etching period. It is concluded that the hillocks are artifacts. The number and size of pores intersecting the etched surface of an irradiated U specimen were estimated after an etching period of 20 min and after an additional etching period of 70 min. The reproducibility in the estimates of pore volume distribution curves, total pore volumes, and total pore densities is strong support for the conclusion that pores in irradiated U etched by ion bombardment are not enlarged or distorted. (auth)

20954 (NMI-2104) FUNDAMENTAL AND APPLIED RESEARCH AND DEVELOPMENT IN METALLURGY. Progress Report to United States Atomic Energy Commission for February 1962. (Nuclear Metals, Inc., Concord, Mass.). May 4, 1962. Contract AT(30-1)-2784. 35p.

Research progress is reported on studies of high-temperature properties of refractory metal alloys, fundamental studies of the corrosion of zirconium alloys, irradiation behavior of metastable beta phase alloys, and fundamentals of single crystal deformation in zone-refined beryllium. (M.C.G.)

20955 (NMI-2105) FUNDAMENTAL AND APPLIED RESEARCH AND DEVELOPMENT IN METALLURGY. Progress Report to United States Atomic Energy Commission, March 1962. (Nuclear Metals, Inc., Concord, Mass.). May 24, 1962. Contract AT(30-1)-2784. 18p.

Investigation was continued to relate high-temperature properties of refractory metal alloys to parameters such as microstructure, atomic structure, and position of the elements in the periodic table. Selected compositions from binary systems containing Hf, Os, Re, and Ru are being investigated. Data on tensile and hot hardness properties of Mo, Mo–Re, Ta–Re, Ta–Ru, and W are given. Continued work is reported on corrosion of Zr alloys, mechanism of failure of thick oxide films, the effects of foreign ion incorporation into ZrO_2 lattices, and zone refining of flake and distilled Be. (J.R.D.)

20956 (NP-10640(Suppl. II)) BERYLLIUM: A SURVEY OF THE LITERATURE, AUGUST–DECEMBER 1961. SUPPLEMENT II. Jack B. Goldmann, comp. (Lockheed Aircraft Corp. Missiles and Space Div., Sunnyvale, Calif.).

Mar. 1962. Contract NORD-17017. 137p. (SB-61-35 (Suppl. II)).

A bibliography of publications is presented under the subject headings of alloys, analysis, applications, compounds, corrosion, fabrication, joining, powder metallurgy, and properties. Several sources were searched. (309 references). (J.R.D.)

20957 (NP-11677) ALL-METAL SANDWICHES EXCEPT HONEYCOMB-CORE: AN ANNOTATED BIBLIOGRAPHY. Eugene E. Graziano, comp. (Lockheed Aircraft Corp. Missiles and Space Div., Sunnyvale, Calif.). Jan. 1962. Contract AF647/787. 81p. (SB-62-8)

The purpose of this search was to discover existing literature relating to all-metal sandwiches, except honeycomb-core, published from January 1956 to date, that might be of interest in space vehicle and missile applications. A total of 192 references is given. Citations are annotated except when items were classified or not available. (auth)

20958 (NP-11702) PREPARATION AND EVALUATION OF HIGH PURITY BERYLLIUM. Quarterly Progress Report, October 2, 1961 to April 2, 1962. G. E. Spangler, M. Herman, E. J. Arndt, D. B. Hoover, V. V. Damiano, and G. S. Tint (Franklin Inst. Labs. for Research and Development, Philadelphia). Contract NOw 62-0536-d. 47p. (Q-B1933-1&2).

Activities in a program to produce high-purity Be and to study its deformation and fracture characteristics are reported. Work is reported on mechanical testing, polycrystalline Be studies, transmission electron microscopy of Be foils and studies of electric resistivity by eddy current techniques. It was found that the eddy current method works well for obtaining relatively accurate measurements of resistivities, when the data are taken for times between about 1 and 3 time constants. It is also possible to measure changes in resistivity in a non-homogeneous sample by this method. The data obtained after about 3 time constants are not well understood. The $\ln \epsilon$ vs time plots either become distinctly curved, drop off or curve at one end, or yield values of resistivity significantly different than the average. It is thought that this may be an instrumental effect resulting from a low frequency cut-off somewhere in the system. A device is being built which will enable the whole system to be operated at liquid He temperatures with which resistivity ratios can be obtained for $\frac{1}{4}$ in. diameter Be rods. (J.R.D.)

20959 (NP-11703) RESEARCH AND DEVELOPMENT OF HIGH TEMPERATURE STRUCTURAL ADHESIVES. Quarterly Progress Report No. 6, February 1, 1962 to May 15, 1962. (Narmco, Inc., San Diego, Calif.). May 1962. Contract NOw 61-0254-c. 50p.

Elemental analyses of a phenolic resin after pyrolysis in an inert atmosphere gave additional support to the postulated formation of condensed ring systems. Spectroscopic studies of pyrolyzed phenolic resin did not yield as much information as expected. "In situ" syntheses of semi-inorganic polymers through pyrolysis of silicone-phenolic laminates in the presence of hydrogen sulfide at 1500°F resulted in specimens with improved oxidation resistance. Constructive pyrolysis of phenolic laminates at 1800°F showed the same very large decrease in volume resistivity as previously observed with silicone-phenolic laminates. Smoking was eliminated from arsenic thioarsenate cure of epoxy-novolac adhesive at lower cure temperature, followed by a post cure. However, the resulting bonds had poorer tensile shear strengths. Antimony thioarsenate was inferior to arsenic thioarsenate as a curing agent for epoxy-novolac adhesive. Oxidative pyrolysis of bis-(2-hydroxyphenyl)-methane at 290 to 295°C resulted in dehydration of the hydroxy groups and in cleavage of the methylene bridges. The pyrolysis mechanism seems to be independent of small amounts of perylene in the system. Oxidation of bis-(2-hydroxyphenyl)-sulfide at 260°C yielded some spectroscopic evidences for formation of sulfoxide and sulfone moieties and proof for the rupture of sulfide bridges. Pyrolysis of diphenyldifluoromethane at 220 to 230°C in the presence of air resulted mostly in benzophenone formation. Reaction of thiophenol and formaldehyde in open and closed systems yielded low melting waxy solids. Reactions of tetra(dimethylamine)diboron with cacodylic acid, triphenylsilanol, diphenylsilanediol, and benzenearsonic acid resulted in structurally not yet identified products. Treatment of a novolac with cacodylic acid or benzenearsonic acid improved the heat stability as shown by the lowered weight losses at elevated temperatures. (auth)

20960 (ORNL-3225) PREPARATION AND FABRICATION OF ThO_2 FUELS. D. E. Ferguson, E. D. Arnold, W. S. Ernst, Jr., and O. C. Dean (Oak Ridge National Lab., Tenn.). June 19, 1962. Contract W-7405-eng-26. 28p.

Dense particles of ThO_2-UO_2 were prepared by a sol-gel process and vibratorily compacted into metal tubes to a density approaching 9.0 g/cc. The steps in this method are all simple and can be carried out behind shielding, which is necessary for refabricating U^{233} fuels. The sol-gel process consists of preparing a hydrous thoria sol, adding the U^{233} as nitrate solution, evaporating to a gel, and finally calcining to almost theoretically dense oxide particles at only 1150°C. The sol-gel-prepared oxide, after being sized, was compacted with a simple, inexpensive pneumatic vibrator. (auth)

20961 (UNC-1001) CHARACTERIZATION OF UO_2 POWDERS. Quarterly Report No. 5, October 10, 1961 to January 10, 1962. James F. Carpenter, Carl W. Kuhlman, and Robert A. Nelson (United Nuclear Corp. Chemical Div., Hematite, Mo.). Mar. 21, 1962. Contract AT(40-1)-2699). 17p.

The particle size distribution of UO_2 powders gave good correlation with the sintered density of pellets. The method involves gravity sedimentation techniques. The green pressing step of pellet fabrication was found to affect the particle size distribution of the UO_2 powders. The magnitude of this effect is considered in characterization of the pressed powders. (J.R.D.)

20962 BERYLLIUM—SOME FIGURES CONCERNING ITS ECONOMIC ASPECTS. Énergie nucléaire, 4: 129-35 (Mar.-Apr. 1962). (In French)

The applicability of Be in nuclear uses (reactor structures, reflectors, moderators, and fuel cladding) is reviewed. An outline is given of research, power, and space (SNAP) reactors using Be or BeO in some capacity. The space and metallurgical uses of Be are also reviewed. The world production, consumption, reserves, and stockpiling of Be are discussed. Locations of plants for processing Be minerals and for preparing Be and BeO are given for the U. S., France, and Britain. World prices of beryl concentrates and Be metal are tabulated. (T.F.H.)

20963 PREPARATION OF THORIUM THIN LAYERS THROUGH ELECTROLYTICAL DEPOSITION ON DIFFERENT METALLIC SUPPORTS. E. Cerrai, R. Dugnani, F. Gazzarrini (CISE, Milan). Energia nucleare (Milan), 9: 200-5 (Apr. 1962). (In Italian)

A method for the electrolytic deposition of thin thorium layers was described. Nickel, nickel plated aluminum, and stainless steel (AISI 304) were used as support layers. The

electrolyte was formed by 14 g/l of ammonium oxalate and thorium from 0.5 to 75 mg/l. The deposition yield was determined as a function of electrolysis duration and of thorium concentration in electrolyte. It was shown that pH value does not affect the deposition yield within pH = 3.5 and 5.5. Layers containing up to 0.2 mg Th/cm^2 were obtained. Deposition yields were obtained from about 77 and 96% on nickel and stainless steel and from 62 to 96% for nickel plated aluminum. Moreover the presence of a co-depositing metal like chromium can sensibly increase the deposition yield (above 87%). The alpha spectra of the layers show resolution of energy peaks from 2 to 2.5%. (auth)

20964 SOLID STATE REACTIONS BETWEEN NUCLEAR FUEL MATERIALS. G. L. Hanna (Australian Atomic Energy Commission, Lucas Heights, New South Wales). J. Australian Inst. Metals, 7: 1-9(Feb. 1962).

In nuclear fuel elements, where different materials are in intimate contact, solid-state reactions can limit both the life and operating temperature of the element. Examples of this type of compatibility problem are described and a discussion is given of the factors which determine the reaction rates and the structure of the reaction zones produced. (auth)

20965 STRAIN HARDENING IN THE YIELDED COMPOUND CYLINDER. S. J. Becker and H. Kraus (Westinghouse Electric Corp., Pittsburgh). J. Eng. Ind., 84: 220-4 (May 1962).

The theory developed for nonhardening plastic deformation of simple and compound cylinders in axisymmetric generalized plane strain was extended to include linear strain hardening in the plastic range. The method, which is limited to small strains, uses a modified Tresca yield condition and assumes incompressibility for both the plastic and the elastic ranges. (auth)

20966 THE MECHANISM OF CATHODE PROCESS IN THE PREPARATION OF THORIUM–ZINC ALLOYS IN FUSED SALTS. II. INVESTIGATIONS ON ZnF_2. S. Minc and W. Rafalski (Inst. of Nuclear Research, Polish Academy of Sciences, Warsaw). Nukleonika, 7: 95-100(1962). (In Russian)

The decomposition voltage of ZnF_2 in fused CaF_2 and ThF_4 at 1100°C is determined. (auth)

20967 SOME PROBLEMS OF VACUUM METALLURGY. A. [M.] Samarin (Academy of Sciences, Moscow). Vide, 17: 53-71(Jan.-Feb. 1962). (In English and French)

Vacuum techniques for producing metals are described along with the features of several types of vacuum furnaces. The furnaces discussed are: induction, arc, and electron beam types. Some of the problems considered are improvement of melting furnaces, operation techniques used in various types of furnaces, thermodynamics and kinetics of metallurgical reactions, effects of suboxides in melting process, and choice of vacuum pumps. The various methods of vacuum treating liquid steel are described. (N.W.R.)

20968 CONTRIBUTION TO THE INVESTIGATION OF THE ELECTRIC ARC METAL SPUTTERING PROCESSES. Alexander Matting and Hans-Dieter Steffens (Technische Hochschule, Hannover). Z. Metallk., 53: 138-44(Feb. 1962). (In German)

The metal spraying of steel, pure aluminum, and copper using an electric arc under compressed air has been investigated. Film-shots show characteristic stages of the arc, and conclusions are drawn for the application and improvement of this process. (auth)

20969 ELECTROLYTIC REFINEMENT OF METALS. Polykarp Herasymenko. U. S. Patent 3,036,961. May 29, 1962.

A process is given for the continuous electrolytic refinement of high-melting reactive metals such as Ti, Zr, Hf, Th, Nb, U, Be, etc. In this process, a solid alloy anode is used which consists of the reactive metal and a less reactive metal with a low melting point, e.g., Pb, Sn, Bi, or Zn. The anode is immersed in a molten salt electrolyte, and an electromotive force is applied to the anode so that ions of the reactive metal are released from the anode to the electrolyte. When the material at the anode surface is depleted sufficiently in the reactive metal, it drops off from the surface in the liquid phase and sinks to the bottom of the cell, thus clearing the anode surface. Examples of the process are given in which Ti and Zr are refined. (D.L.C.)

20970 PASSIVATION OF REACTIVE METAL SURFACES. Virgil F. Novy and Craig G. Kirkpatrick (to Nuclear Corp. of America, Inc.). U. S. Patent 3,038,824. June 12, 1962.

A method is outlined for passivating the polished surface of a rare earth metal. The method comprises treating the polished surface with a solvent such as C_2H_5OH to remove grinding and polishing material, applying nital (5% HNO_3, 95% C_2H_5OH) to the surface, removing the deposit or color formed by nital, repeating the method until there is no color change after the nital treatment, and drying the surface. Photomicrographs are given of untreated and treated Ce, La, Pr, and Nd surfaces. (D.L.C.)

Corrosion

20971 (AD-266150) RARE EARTH INTERMETALLICS. Bi-monthly Report No. 2, January 15 to March 15, 1961. (Research Chemicals. Div. of Nuclear Corp. of America, Burbank, Calif.). Contract NOw61-0257-c. 11p. (RC-173)

Intermetallics in the Hf–Re system had corrosion rates greater than pure Hf. Alloys containing more than 10% Re all lost weight at the 1000°C test temperature. Corrosion rate data in the Hf–Dy system are presented in tabular form. The rate is apparently proportional to the Dy content. The data in the Hf–B system are of considerable interest. Although arc melting procedures did not produce intermetallics of the desired B content, nevertheless the results indicate a considerable decrease in corrosion rates due to the formation of a hafnium boride. Preliminary experiments were conducted with intermetallics of the rare earths with phosphorus. A preliminary check in the Yt–P system shows considerable improvement in corrosion resistance. (auth)

20972 (AGC-0584-04-2) MERCURY CORROSION LOOP TESTING PROGRAM. Quarterly Report, January 1 through March 31, 1962. (Aerojet-General Corp., Azusa, Calif.). Apr. 27, 1962. Contract NAS 3-1925. 34p.

The Mercury Corrosion Loop Testing Program was continued. Materials to be tested in the 10 forced-convection test loops were selected; the materials are: Haynes 25, 9 Cr–1Mo alloy clad with Type 316 stainless steel, AM 350 stainless steel, and niobium clad with Type 316 stainless steel. The eight-test-cell facility was completed and all utilities were installed. Pneumatic and electronic instrumentation for all test cells was installed and calibrated. Fabrication was initiated on the first four Haynes 25 loops. The first loop was 85% assembled at the end of the quarter. A centrifugal pump made from Type 316 stainless steel was tested; bearing modifications were made to improve operation. (auth)

20973 (ARF-2198-18) IMPROVED ZIRCONIUM ALLOYS. Quarterly Report, April 1, 1961–June 30, 1961. Daniel Weinstein and F. C. Holtz (Illinois Inst. of Tech., Chicago. Armour Research Foundation). July 11, 1961. Work performed under United States–Euratom Joint Research and Development Program. Contract AT(11-1)-578. 12p. (EURAEC-138)

Progress reported includes the selection of 15 ternary bases for further study in steam or water. About 75 compositions were prepared and are being arc-melted for fabrication into corrosion specimens. Investigations of Zr purity and heat treatment effects on corrosion are being continued. Included are data from corrosion tests on binary alloys with superheated water and steam, and a list of alloys for initial investigation based on results of corrosion screening tests. (J.R.D.)

20974 (BMI-X-198) CORROSION INVESTIGATION OF EXPERIMENTAL ALLOYS UNDER HYDROFLUORINATOR CONDITIONS. P. D. Miller, E. F. Stephan, and F. W. Fink (Battelle Memorial Inst., Columbus, Ohio). Apr. 20, 1962. Contract [W-7405-eng-92]. 11p.

Investigations are described in which Ni-base alloys containing various amounts of Mo, Fe, V, and others were exposed to high-temperature salt solutions. The molten salt was composed of NaF, LiF, and BeF_2. Results show that HyMu-80 (Ni-80%, Mo-4%, Fe-16%) was somewhat superior to others. (J.R.D.)

20975 (BNL-728) PROCEEDINGS OF THE ELEVENTH ANNUAL AEC CORROSION SYMPOSIUM, MAY 23-25, 1962. John R. Weeks, ed. (Brookhaven National Lab., Upton, N. Y.). Contract [AT(30-2)-Gen-16]. 69p.

Thirty-two papers were presented at the Eleventh Annual AEC Corrosion Symposium. Abstracts are given of the unclassified papers. Classified papers are listed by title only, or, when possible, by an unclassified summary. Three abstracts of papers received but not presented are included. Topics covered include: liquid metals, zirconium and radiation effects, general corrosion, stress corrosion cracking, steel corrosion, and high-temperature corrosion. (M.C.G.)

20976 (BW-3871) SPECIAL CORROSION STUDY OF CARBON AND LOW ALLOY STEELS. R. U. Blaser and James J. Owens (Babcock and Wilcox Co. Research Center, Alliance, Ohio). June 28, 1955. 36p.

Presented at ASTM Symposium on High Purity Water Corrosion, June 28, 1955.

An investigation was conducted to obtain data on the use of carbon steel in pure water cooling systems which in the past were served by stainless steel. Test apparatus, procedures, and observations are given. Data are also given and correlated to some extent with other information. The effects of various water treatments are considered, and the effects of steel corrosion on heat transfer are noted. (J.R.D.)

20977 (CRGM-1082) A PRELIMINARY STUDY OF THE EFFECT OF ADDED FLUORIDE ON THE CORROSION OF Zr-2 IN WATER AT 300°C. F. H. Krenz (Atomic Energy of Canada Ltd., Chalk River, Ont.). Mar. 1962. 25p. (AECL-1507)

Tests are described in which Zircaloy-2 was exposed at 300°C to slowly flowing water containing 10 ppm of added fluoride and adjusted to pH 10 with LiOH. Results show that under some surface conditions, Zircaloy can be severely corroded in 7 to 8 days. It appears that surface preparation, stress and/or strain, fluoride ion concentration and inhibiting agents are involved. (J.R.D.)

20978 (DP-683) STRESS-CORROSION CRACKING OF STAINLESS STEEL. A Literature Search. Myra S. Feldman (Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.). Feb. 1962. Contract AT(07-2)-1. 67p.

References on the stress-corrosion cracking of stainless steel were abstracted from the open literature through September 1961. (auth)

20979 (HW-71958-RD) THE RELATION OF FRACTION CORROSION PRODUCT HYDROGEN PICKUP TO LAYER STRUCTURE IN THE ZIRCONIUM OXIDE CORROSION PRODUCT. R. L. Dillon, B. Griggs, H. P. Maffei, and D. W. Shannon (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Dec. 6, 1961. Contract [AT(45-1)-1350]. 8p.

In corrosion evaluation of zirconium alloys, it was found that the fraction pickup of corrosion product hydrogen increases after transition. The relationship of percent hydrogen pickup to presence of oxygen in the stream and the changes in the corrosion product associated with breakaway was studied. It is shown that changes in corrosion product structure at transition effectively produce a change in the corrosion environment as well. Increasing ratios of hydrogen to steam partial pressures within the corrosion product after transition are postulated. (M.C.G.)

20980 (EURAEC-26) INVESTIGATION ON ALLOYS OF ZIRCONIUM WITH NIOBIUM AND/OR SILICON IN VIEW OF THEIR USE AS SHEATHING MATERIAL IN WATER COOLED REACTORS. Quarterly Report No. 1, April 1, 1960 through June 30, 1960. K. Anderko, H. Richter, and H.-W. Schleicher (Metallgesellschaft A. G., Frankfurt am Main). July 18, 1960. Work performed under United States–Euratom Joint Research and Development Program. Contract [009-60-4RDA]. 21p. A Translation.

Samples required for the investigation of zirconium-niobium alloys, zirconium-niobium-tin alloys and of zirconium-silicon alloys were prepared. Several etching processes were developed for the metallographic examination which would be the most appropriate for the various alloys. The zirconium-niobium alloys with 1 and 3% niobium respectively, were subjected to numerous heat treatments and the effect of the latter on the resistance to corrosion was determined according to the standard corrosion test (14 days exposure to steam at 400°C, 200 atm.). The first results pointed to the fact that the samples which had the highest resistance to corrosion were those which had been annealed in the α range; the resistance to corrosion decreased if annealing had been carried out in the β or in the $\alpha + \beta$ range. (auth)

20981 (EURAEC-27) INVESTIGATION ON ALLOYS OF ZIRCONIUM WITH NIOBIUM AND/OR SILICON IN VIEW OF THEIR USE AS SHEATHING MATERIAL IN WATER-COOLED NUCLEAR REACTORS. Quarterly Report No. 2, July 1 to September 30, 1960. K. Anderko, W. Jung-Koenig, H. Richter, H.-W. Schleicher, and U. Zwicker (Metallgesellschaft A. G., Frankfurt am Main). Oct. 17, 1960. Work Performed under United States–Euratom Joint Research and Development Program. Contract [009-60-4RDA]. 55p. A Translation.

An investigation was made on the constitution of binary Zr-Nb alloys. A few discrepancies in the constitutional diagram of zirconium–niobium could be explained to a considerable extent. It thus appeared that the solubility of niobium in zirconium was highest at about 590°C, as well in alloys containing spongy zirconium as in alloys which contained iodide zirconium. The maximum solubility of niobium is of the order of 1.5 to 2% in spongy zirconium,

whereas it reaches slightly over 2% for iodide-zirconium. The temperature of the monotectoid reaction was previously determined only for alloys which were prepared with spongy zirconium, and it was found that the conversion begins in the neighborhood of 590°C. An investigation into the influence of the cooling rate on the texture revealed that by quenching in water alloys with niobium contents ranging between 7.5 and 17%, a separation of martensitic platelets takes place. The comparative corrosion tests in steam at 400°C and 200 atm were continued and extended by tests at 360 and 480°C. As a result of these tests, it appeared that the resistance to corrosion is definitely related to the final annealing temperature and thus also to the texture. The best resistance to corrosion was obtained by annealing at 590°C, the highest annealing temperature to be used so far. The alloys Zircaloy-2 and $ZrNb_2$, which were prepared for the endurance tests, were subjected to tensile tests at room temperature and at higher temperatures up to 450°C. It was found thereby that the alloy with a certain niobium content was decidedly superior to the Zircaloy-2 standard alloy at the higher temperatures. (auth)

20982 (EURAEC-85) INVESTIGATION ON ALLOYS OF ZIRCONIUM WITH NIOBIUM AND/OR SILICON IN VIEW OF THEIR USE AS SHEATHING MATERIAL IN WATER-COOLED NUCLEAR REACTORS. Quarterly Report No. 3. K. Anderko, W. Jung-Koenig, H. Richter, H.-W. Schleicher, and U. Zwicker (Metallgesellschaft A. G., Frankfurt am Main). Jan. 5, 1961. Work performed under United States–Euratom Joint Research and Development Program. Contract [009-60-4RDA]. 35p. A Translation.

Investigation of Zr–Nb system was resumed and the results of the previous investigation were confirmed. The temperature dependence of the solubility of niobium in the mixed crystal of α-zirconium was determined both with spongy zirconium and iodide zirconium as starting material. On account of the impurities contained in spongy zirconium, the equilibrium temperature of the alloy in the monotectoid range, as well as the $\beta/\alpha + \beta$ phase boundary were shifted toward considerably higher temperatures compared to alloys with iodide zirconium as starting material. The martensitic platelets which separate in alloys with niobium contents ranging between 7.5 and 17% of niobium when quenched in water, could be ascribed to the presence of hydrogen. The comparative corrosion tests in water or steam at 360, 400, and 480°C respectively, were extended. The first series of 2,000-hour tests at 400°C and 1,000 h tests at 480°C were brought to an end. An investigation on the hydrogen absorption of a few alloys with niobium content during the corrosion process was made and resulted in considerably lower values than those which can be observed with Zircaloy-2. In a new series of tests, binary, ternary and quaternary zirconium alloys with niobium content were subjected to the action of water or steam at 350, 400, and 480°C after having been heat-treated for 10 days at 575°C or 1 hour at 650°C. The results of these experiments after 500 hours show that the heat treatment at 575°C is beneficial and thus confirms the opinion which had already arisen, that annealing below the monotectoid range has a particularly favorable influence. The systematic corrosion tests pointed to the fact that alloys with 3% of niobium and 1% of tin were particularly promising. The alloys Zircaloy-2 and $ZrNb_2$ intended for the endurance tests when treated at temperatures of 250, 350, and 450°C, exhibited permanent elongations after times extending even up to 500 hours. (auth)

20983 PERFORMANCE OF TITANIUM vs OTHER MATERIALS IN CHEMICAL PLANT EXPOSURES. R. S. Sheppard, D. R. Hise, P. J. Gegner, and W. L. Wilson (Pittsburgh Plate Glass Co., Barberton, Ohio). Corrosion, 18: 211t-18t(June 1962).

Results of exposures yielding corrosion rates on titanium and 49 other materials are given. Corrosion spool results were confirmed in a number of instances by testing titanium equipment. Valves, reboilers, heating coils, cooling coils, steam tracer tubing, atomizer wheels, pump impellers, equipment plates, and thermowells were installed in environments such as calcium chloride liquors, hypochlorous acid, wet chlorine gas, calcium hypochlorite solution, chlorine-containing sodium chloride brine, and nitric acid. Failures of titanium equipment were rare. Permanent use of titanium appeared to be justified in the majority of installations. (auth)

20984 EVALUATION OF NUCLEAR REACTOR DECONTAMINANTS. R. D. Weed (General Electric Co., Richland, Wash.). Corrosion, 18: 224t-9t(June 1962). (HW-SA-2218)

Test facilities and evaluation procedures used in designating optimum conditions and method for decontamination are described. Decontaminants based on sulfamic acid, dibasic ammonium citrate, and sodium bisulfate were tested in several tests of the procedure. All appear to be satisfactory for decontaminating carbon steel systems but present corrosion problems. If the reactor piping is at least partly of stainless steel, the reagents are not effective unless a preliminary conditioning step is used. The most effective conditioning step was treatment at 105°C with alkaline permanganate solution. Two major problems observed during testing of various decontaminants are: galvanic corrosion at the junction of carbon steel-stainless steel welded specimens, which is promoted by the presence of oxygen; and dendritic attack by alkaline permanganate solution on certain alloys used for valve facing. (P.C.H.)

20985 STUDY OF THE INFLUENCE OF VARIOUS FACTORS ON THE CORROSION OF ZIRCALOY BY HIGH TEMPERATURE WATER OR STEAM AND ON THE ABSORPTION OF HYDROGEN BY THE METAL. H. Coriou, L. Grall, J. Huré, M. Pelras, and H. Willermoz. Énergie nucléaire, 4: 109-19(Mar.-Apr. 1962). (In French)

In the field of corrosion and hydrogen absorption by the metal, the effects of the following factors are studied: thermal flux; vibrations; pressure; the addition of lithium hydroxide; and thermal cycling. These factors may all be met in the operation of reactors. (auth)

20986 CORROSION OF ALLOY STEELS IN CARBON DIOXIDE. A. Draycott, B. J. Fox, and R. W. Hubery (Australian Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales). J. Australian Inst. Metals, 7: 76-84(Feb. 1962).

The corrosion of 1% Cr, ½% Mo and 2¼% Cr, 1% Mo steels in carbon dioxide was measured within the temperature range 450 to 500°C and the pressure range 0 to 15 atmospheres. The effects of gas velocity, surface preparation, and water content of the gas were also determined. Some results of a 12% Cr, 1% Ni steel are included within the temperature range 600 to 725°C. Under semi-static conditions both low alloy steels formed adherent oxide scales of the $Fe_3O_4-Fe_2O_3$ type together with an unidentified spinel. The weight gains obtained were dependent on temperature and varied little with gas pressure, water content of gas, or surface treatment of the metal. A cubic relationship was found to best fit the weight gain-time results, and weight gains varied from 1.7 mg/cm^2 to a maximum of 5.2 mg/cm^2 after 1000 hours exposure within the temperature range investigated. The 12% steel had a weight gain

range of 0.05 to 0.47 mg/cm^2 after 1000 hours at the higher temperatures. Some scaling occurred in high velocity gas, the extent being much greater for the 1% Cr, ½% Mo steel. Weight gains varied from 0.7 mg/cm^2 at 450°C to 2.5 mg/cm^2 at 525°C after 100 hours at a velocity of 100 ft/sec. It was observed that the relative thickness of the Fe_2O_3 scale was much greater under flowing gas than under semi-static conditions. (auth)

Fabrication

20987 (AD-266249) ULTRASONIC WELDING OF REFRACTORY METALS. Progress Report No. 3, June 1 through July 31, 1961. C. R. Frownfelter (Aeroprojects, Inc., West Chester, Penna.). Oct. 25, 1961. Contract Now 61-4410-c. 6p.

The effect of input power, clamping force, and duration of welding interval on the tensile-shear strength of ultrasonic welds in 0.005-in. Mo–0.5% Ti alloy sheet were studied and the results are tabulated. Exploratory tensile-shear measurements were made in 0.010-in. Mo–0.5% Ti alloy sheets welded with 1800 w applied for 0.6 sec and clamping force levels of 400 and 350 lb. No correlation between weld strength and clamping force was obtained for 0.005-in. W sheets welded at 1600 w, a weld interval of 0.3 sec, and clamping forces from 300 to 900 lb. The effects of etching and degreasing of 0.005-in. D-31 alloy prior to welding were compared. (auth)

20988 (ARF-2232-2) FEASIBILITY STUDY OF FIBER METAL RESISTANCE BRAZING OF MOLYBDENUM SHEET. Final Report, September 25, 1961 to March 25, 1962. Robert K. Nolen and John F. Rudy (Illinois Inst. of Tech., Chicago. Armour Research Foundation). Apr. 18, 1962. Contract NOw-62-0387-d. 48p.

The feasibility of joining Mo-0.50 Ti-0.10 Zr by the fiber metal resistance brazing process was demonstrated. Metallic fiber compositions at the faying plane concentrate the heat at the interface, reducing the current required and thereby eliminating the two undesirable effects of temperature—electrode-base metal bonding and recrystallization of the base alloy. Increased remelt temperature of the resistance brazed joint, due to local composition changes within the heterogeneous brazing shim during brazing, were demonstrated as feasible, but procedural improvements are indicated which should provide greater increases. Typical microstructures are presented for a number of brazing shim compositions, and a limited amount of mechanical property and remelt temperature data are presented. A program of future effort is outlined, based on the feasibility of the fiber metal resistance brazing process for joining refractory metals, which was demonstrated, and also based on suggested directions for improvement. (auth)

20989 (ASD-TN-61-32) A LABORATORY ARC MELTING FURNACE FOR THE PRODUCTION OF ALLOY SAMPLES FROM REACTIVE METALS. John C. Olson (Aeronautical Systems Div. Materials Central, Wright-Patterson AFB, Ohio). Mar. 1961. 16p. (AD-266251).

An arc melting furnace for the production of small samples of alloys and intermetallic compounds was designed and built. It is used in phase diagram investigations involving reactive materials such as rare earth metals. It was also used for the laboratory scale preparation of nickel–copper alloys being studied for magnetic thermometry. The design, capabilities, and operation of the furnace are described. (auth)

20990 (ASD-TR-7-532a(VI)) MACHINING OF REFRACTORY MATERIALS. Phase II Technical Engineering Report, February 1, 1962 to April 30, 1962. L. J. Nowikowski, N. Zlatin, and M. Field (Metcut Research Associates Inc., Cincinnati). May 1962. Contract AF 33 (600)-42349. 108p.

Machining studies were performed on pressed and sintered unalloyed tungsten, D-31 niobium alloy, 90Ta-10W alloy, molybdenum TZM and Mo-0.5% Ti alloys, and a high temperature glass ceramic material. The investigation consisted of drilling and grinding tests on tungsten; turning, face milling, and grinding on D-31 niobium, turning, drilling, reaming, and tapping on 90Ta-10W alloy; face milling, end milling, drilling, reaming, tapping, and grinding on molybdenum alloys; and grinding of the high temperature glass ceramic. A drill life of 27 holes was obtained on tungsten heated to 800°F using a 0.213 in. dia. solid carbide drill at 200 ft/min. In grinding, a G Ratio of 5.2 was obtained with a 32A46N5VBE wheel. In turning D-31 niobium, a tool life of 35 minutes was obtained at 300 ft/min. with a C-2 (K6) carbide, and a cutter life of 100 in. of work travel in face milling with an M-2 HSS cutter at 98 ft/min. The best G Ratio, 7.5 for grinding D-31 was obtained with a 32A46K8VBE wheel using a KNO_2 solution grinding fluid. The 90Ta-10W alloy was somewhat more difficult to machine. Tool life in turning with a C-2 (K6) carbide was 25 min at 100 ft/min. In drilling, 45 holes were obtained with a 0.193 in. dia. M-1 HSS drill at 50 ft/min. Reaming with a 0.213 in. dia. M-2 HSS reamer at 85 ft/min gave 68 holes, and a tap life of 60 holes was obtained at 4 ft/min with a 1/4-28 M-10 HSS tap. In milling TZM molybdenum with a C-2 (883) carbide face mill at 350 ft/min a cutter life of 110 in. of work travel was obtained. A T-15 HSS end mill produced 80 in. of work travel at 190 ft/min. Drilling with a 0.250 in. dia. M-1 HSS drill produced 100 holes at 125 ft/min and reaming with a 0.272 in. dia. M-2 HSS reamer gave a tool life of 50 holes at 60 ft/min. Tapping with a 5/16-24 M-10 HSS tap at 70 ft/min produced 100 holes. Grinding ratios of 15 to 25 were obtained using aluminum oxide wheels with KNO_2 solution as a grinding fluid. Silicon carbide wheels gave the best G Ratios, 30 to 40, in grinding a high temperature glass ceramic. Wheel speeds of 5000 to 6000 ft/min and a down feed of 0.002 in./pass produced the best G Ratio. (auth)

20991 (ASD-TR-7-647(VI)) BERYLLIUM FORGING PROGRAM. Interim Technical Engineering Report, April 1, 1961 to September 30, 1961. A. F. Hayes and J. A. Yoblin (Ladish Co., Cudahy, Wis.). Nov. 1961. Contract AF 33(600)-36795. 46p. (AD-266876).

Unclad Be was forged in closed dies on an experimental production basis using expendable die components of hot carbon steel which reduce tensile stresses while deforming plastically. Reproducibility was achieved through development of tooling and forging sequences applicable to the specific shapes required. The final forging configuration for 2 parts was produced repetitively while production runs of the initial, extrusion forging operation were also completed for 2 other parts. Preliminary tryouts are being conducted on the 2 remaining parts which have thin wall configurations. A successful method for ring rolling Be was not developed although results were sufficiently encouraging to warrant further investigation. A heat treatment investigation on separate heats of Be indicated that, within the limits of the treatments and the specific forgings investigated, a temperature of 1525°F for 16 hr followed by air cooling, imparts the most desirable combination of properties. (auth)

20992 (ASD-TR-7-783(III)) TANTALUM EXTRUSION PROGRAM. Interim Technical Engineering Report, Phase III, January 25, 1962–April 25, 1962. Mark D.

McNabb, James Wong (Wah Chang Corp., Albany, Ore.) and Jack Preston—E. S. Guidoboni, ed. (Allegheny Ludlum Steel Corp. Research Center, Brackenridge, Penna.). Contract AF33(600)-42396. 51p.

Extrusions of Ta–10W alloy during the past report period were characterized by poor surface and dimensional quality. These conditions can be attributed to lubrication and die coating failure, as well as the presence of a contaminated layer on the billet surface. Metallography and analysis of the contaminated layer revealed that a reaction between the glass and Ta-10W occurred during heating. This reaction layer is believed to be partially responsible for the poor wetting and lubricating behavior of the glass. Experiments are planned which should result in improvements in extrusion quality and allow a proper evaluation of billet starting materials. (auth)

20993 (NLCO-842) HOT ROTARY FORGING OF URANIUM TUBING. R. J. Jansen (National Lead Co. of Ohio, Cincinnati). May 31, 1962. Contract AT(30-1)-1156. 62p.

A special, hot rotary forging machine was used to forge extruded normal U tubes to fuel core blanks that were subsequently machined to reactor-grade fuel cores. The dimensional tolerances of the forged core blanks were substantially better than in those of the extruded feed stock, both in OD and in wall thickness variation. As a result, the fabrication of the blanks to fuel cores required less machining time and generated less scrap than normally experienced in the conventional rolling, machining, drilling route. An analysis of grain size and texture revealed that the structures of the forged cores were equivalent in every respect to the normal production product. The U forging test was preceded by a test using steel feed stock to determing operating parameters and establish tooling requirements for the main test. (auth)

20994 (NP-11621) A STUDY OF EXPLOSIVE FORMING SELECTED REFRACTORY METALS. Final Program Report No. 1096-5F. (Chromalloy Corp. Propellex Chemical Div., Edwardsville, Ill.). Apr. 1, 1962. Contract NOw-61-0832-c. 81p.

The forming characteristics of Mo-0.5% Ti were determined. The strain rate condition was optimized up to and including a forming temperature of 1000°F. An analysis was made of the prime factor to be considered in the choice of a transmission media. The draw ring pressure required to achieve optimum forming was found to be a minimum consistent with basic dye design. The insulation required to protect the explosive charge from thermal detonation was determined. It was found that pre-form diameter should be kept to a minimum in order to achieve maximum draw with the least possible thinning. A solution of 45% HNO_3 and 55% H_2O was found most suitable for etching Mo-$\frac{1}{2}$% Ti and Nb. Analysis of the transfer medium showed that optimum forming can be approached when the time rate of impulse delivery is lengthened and neutralized as opposed to a high rate of progressivity and regressivity. A method was devised for obtaining strain rates at any forming temperature. Results indicated that optimum elongation conditions for Mo-$\frac{1}{2}$% Ti and W could be approached through the use of 40% dynamite for detonation. (M.C.G.)

20995 (NP-11776) PRESSURE WELDING—BIBLIOGRAPHY. (British Welding Research Association, London). 1960. 10p.

A bibliography containing 117 references from the years 1944 to 1961 on pressure welding is presented. (N.W.R.)

20996 (EURAEC-2) STEAM SINTERING OF URANIUM DIOXIDE. Quarterly Report No. 1 (September 1 to November 30, 1960). (FIAT. Sezione Energia Nucleare, Turin). Dec. 31, 1960. Work Performed under United States–Euratom Joint Research and Development Program. Contract 016-60-0-RDF. 31p. A Translation.

The use of a steam atmosphere instead of the more conventional hydrogen atmosphere appeared to be one of the best means of reducing the cost of the sintering process of uranium dioxide for use in the manufacture of fuel elements for nuclear reactors. A program of research was laid down with the object of studying the possibilities of this process. Details are given of the construction and arrangement of the apparatus used. (auth)

20997 (EURAEC-10) SWAGING OF URANIUM OXIDE. Quarterly Report No. 1 (May to July 31, 1960). (FIAT. Sezione Energia Nucleare, Turin). Aug. 31, 1960. Work performed under United States–Euratom Joint Research and Development Program. Contract 013-60-5RDI. 28p. A Translation.

The effects of various parameters on the characteristics of swaged tubes of stainless steel or Zircaloy-2 compacted with UO_2 powder are being studied. The equipment and materials are discussed along with previous research efforts. The techniques evolved for the production of the test specimens required for the study of the swaging parameters, thermal conductivity, and gamma absorption of swaged UO_2 are described. Preliminary tests provided evidence that densities close to 93% theoretical density can be reached. (M.C.G.)

20998 (EURAEC-220) STUDY OF THE SHAPING AND THE IRRADIATION OF URANIUM MONOCARBIDE. Quarterly Progress Report No. 3, June 15 to September 15, 1961 [on] PREPARATION AND IRRADIATION OF U–UC CERMETS AND STOICHIOMETRIC UC. (France. Commissariat à l'Energie Atomique, Paris). Oct. 10, 1961. Work performed under United States–Euratom Joint Research and Development Program. Contract 012-60-5RDF. 28p. A translation.

Extrusion of 2 and 4% C U–C mixtures were made in Cu pots at high extrusion rates at 800°C. A considerable sintering rate was obtained along with continuous canning. In other work a 4.6% C UC element was inserted in the E.L.3 pile for irradiation. Results of hydrolysis tests on UC indicate that the carbide prepared by arc fusion is more stable than that prepared by sintering under load. (J.R.D.)

20999 (EURAEC-247) STUDY OF SHAPING AND IRRADIATION OF URANIUM MONOCARBIDE. Quarterly Progress Report No. 4, October 1 to December 31, 1961 [on] PREPARATION AND IRRADIATION OF U–UC CERMETS AND STOICHIOMETRIC UC. (France. Commissariat à l'Énergie Atomique, Paris). Jan. 8, 1962. Work performed under United States–Euratom Joint Research and Development Program. Contract 012-60-5RDF. 41p. A translation of CEA-3748.

Extrusion tests involving U–C mixtures with 4% C were made in Cu pots. The sintering rate at 12 to 30 M/min was high but the U–C reaction was almost non-existent. Only rods extruded at low rates were correctly canned. Irradiation of canned UC at an average flux of 3.7×10^{3} N/cm^2 for a month is reported. Satisfactory results were obtained and the test is continuing. Other irradiation tests are planned. (J.R.D.)

21000 ELECTRON BEAM WELDING. R. Goebel, E. Heinze, W. Neumann, E. Rexer, and K. Schlaubitz (Institut für Angewandte Physik der Reinstoffe, Dresden). Kernenergie, 5: 104-11(Feb. 1962). (In German)

Electron beam welding is of interest for special applications. After some introductory remarks on the conditions

which have led to the development of this welding technique, the physical engineering principles of the method are reported. A survey of the known installations is given. The instruments can be divided into three groups according to their construction characteristics. An apparatus developed at the Institut für Angewandte Physik der Reinstoffe, Dresden and some welding studies made there are reported. (tr-auth)

21001 EXTRUSION CLADDING OF URANIUM–ZIRCONIUM TUBULAR FUEL ELEMENTS. Ch. Sauve (Commissariat à l'Énergie Atomique, Saclay, France). Mém. sci. rev. mét., 59: 208-24(Mar. 1962). (In French)

Tubular fuel elements formed of an alloyed uranium tube jacketed with zirconium were obtained by coextrusion. The 500 tons extruding press of Saclay, with a ram speed not exceeding 4 mm/s, was used for that purpose, with an extrusion ratio of 13. Preparation of the billet elements, their assembly and welding, and the extrusion process are described. A description of the fuel elements obtained is then given, together with the results of gamma inspection, hardness tests, micrographs, and heat treatment. (auth)

21002 IMPROVEMENTS IN METHODS OF SINTERING COMPACTS OF METAL SUBSTANCES. (to Mallinckrodt Chemical Works). British Patent 897,689. May 30, 1962.

A continuous method for sintering compacts of metals or metallic oxides is outlined which is particularly useful for sintering dense UO_2 compacts for reactor use. The method comprises dispersing the green compacts in a body of pure granules of a refractory material such as alumina or zirconia, allowing the mixture to gravitate slowly through a vertical tubular furnace wherein the compacts are gradually heated to a temperature sufficient to sinter the compacts but insufficient to melt the compacts or sinter the refractory granules, gradually cooling the mixture, and separating the sintered compacts from the granules. The refractory granules serve to isolate the compacts from each other and from the furnace wall. (D.L.C.)

21003 EXTRUSION PROCESS AND APPARATUS THEREFOR. (to Commissariat à l'Énergie Atomique). British Patent 899,453. June 20, 1962.

An extrusion process using a die with a conical inlet is outlined in which the problem of lubrication is solved. The outlet of the extrusion container is closed with a closure member having a breakage resistance greater than the pressure required to distribute the lubricant throughout the space between the container and the billet but less than the extrusion pressure to be applied to the billet. The billet and lubricant are placed therein, and pressure is then exerted on the billet to push the lubricant into the space between the container and billet. After the pressure breaks the closure member, extrusion begins. (D.L.C.)

21004 NUCLEAR FUEL ELEMENT AND METHOD OF MANUFACTURE. Harry R. Brand and Eli I. Schefer (to Sylvania Electric Products Inc.). U. S. Patent 3,028,326. Apr. 3, 1962.

Fabrication techniques for reactor fuel plate assemblies are described. The assembly technique consists of deforming the side edges of the plates and then stacking the plates in a spaced overlying relation to one another with spacing members between adjacent plates and with the deformed respective side edges of the plates aligned to one another. The stacked plates are then temporarily clamped together as a group. A flat mold cavity is provided and filled with an epoxy resin material to a desired depth corresponding to the thickness of the side supporting member. The clamped plates are maintained in the mold until the resin has cured and hardened to provide a side supporting member for the side edges. The clamps are removed, leaving the desired fuel assembly. (N,W,R.)

21005 NUCLEAR FUEL ELEMENTS HAVING AN AUTOGENOUS MATRIX AND METHOD OF MAKING THE SAME. Clarence I. Justheim and Morgan G. Huntington (to RNB Corp.). U. S. Patent 3,028,330. Apr. 3, 1962.

Designs and production methods for cladding isotopes of uranium and other fissile and fertile materials in a matrix consisting largely of carbon or coke for operation through temperature ranges beyond the vaporization temperature of plutonium carbide are described. The solid fuel is comprised of discrete particles and fragments of fissionable material disposed in a cellular matrix having a plurality of voids therein. This fuel matrix provides containment of the fissionable and fertile isotope fragments through phase changes from solid to liquid and from liquid to solid without rupture of the cells and, at the same time, gaseous products may diffuse and escape without destruction of the cellular matrix. Cermets, ceramics, carbides, or other materials may be used in place of carbon for moderate temperature ranges. (N,W,R.)

21006 RADIATION SHIELD STRUCTURES AND THEIR PRODUCTION. Richard Kieffer and Karl Sedlatschek. (to Schwarzkopf Development Corp.). U. S. Patent 3,039,000. June 12, 1962.

It was found that a solid solution or alloy of W and U consisting of 50 to 95% W and 5 to 50% U or U-rich alloy provides an ideal radiation shield for x rays, radioisotopes, etc. The alloys may be made in a variety of ways, but the preferred way comprises forming a sintered porous skeleton of W powder particles and infiltrating the skeleton with U to give a compact which has a density of ~19 and may be readily machined. The infiltrant may also contain Al up to 10%. (D.L.C.)

Properties and Structure

Refer also to abstracts 20300 and 20372.

21007 (AD-230373) A STUDY OF A CLASS OF INTERMETALLIC COMPOUNDS, THE CHALCOPYRITES. Quarterly Progress Report No. 11, August 1, 1959 to October 31, 1959. (New York Univ., New York. Coll. of Engineering). Nov. 1959. Contract AF33(616)-3959. 8p.

The effects of cumulative annealing on the thermoelectric power were studied on ingots of $AgInTe_2$, $CuInTe_2$, and $Ag_{50}Cu_{50}InTe_2$. The thermoelectric power of $AgInTe_2$ is changed very little by annealing at 150°C, while annealing at 400°C introduces a tendency to produce more positive carriers. The thermoelectric power of $CuInTe_2$ gradually decreases at 600°C. Annealing $Ag_{50}Cu_{50}InTe_2$ at 200°C introduces a reversal of the sign and 500°C further introduces carrier reversion. (J.R.D.)

21008 (AD-263483) THE EFFECT OF GAMMA PRIME PARTICLE SIZE UPON THE HIGH TEMPERATURE PROPERTIES OF NICKEL-BASE ALLOYS. David L. Sponseller and R. A. Flinn (Michigan. Univ., Ann Arbor. Coll. of Engineering). Sept. 1960. 50p. (IP-467)

The investigation was based on the Ni–Cr–Al system at 75 at.% Ni. It was found that as the Al content increases, faster cooling rates from above the solution temperature are required to develop maximum room temperature hardness. Room temperature hardness, as well as tensile strength and creep strength at elevated temperatures also increase initially with increasing Al. An exhaustion effect is noted, by which the room temperature hardness of high-

Al compositions is less sensitive to changes in aging temperature than that of low-Al compositions. Very large particle sizes can be readily developed by slow cooling from above the solution temperature, and an optimum-mean-free-path between gamma prime particles exists, which results in minimum creep rate. This optimum-mean-free-path (along with the corresponding particle size for a given volume percent of gamma prime) varies with applied stress. Mn and Ti expand the lattice of the gamma matrix, and manganese reduces the quantity of gamma prime precipitate. (auth)

21009 (AD-264815) TITANIUM SHEET ROLLING PROGRAM FOR Ti–8Al–1Mo–1V, Ti–5Al–5Sn–5Zr, AND Ti–7Al–12Zr. Eleventh Bimonthly Report, March 1 through April 30, 1961. D. L. Day, D. R. Mitchell, and H. D. Kessler (Titanium Metals Corp. of America. Technical Lab., Toronto, Ohio). Aug. 31, 1961. Contract NOas-59-6227-c. 73p.

A laboratory evaluation of duplex annealed Ti–8Al–1Mo–1V sheet showed that 1850°F (5 min) and air cooled (AC) + 1100°F (8 hr) provided an optimum combination of room- and elevated-temperature tensile, sub-zero temperature notch tensile, and creep properties. Contamination was found to extend to a depth of 0.002 to 0.0025 in., which is entirely commensurate with finish grinding and/or pickling procedures being used. A more extended study of the effect of finish annealing temperature on the creep-stability properties of Ti–5Al–5Sn–5Zr and Ti–7Al–12Zr sheets resulted in the selection of 1650°F ($\frac{1}{2}$ hr) AC as the optimum final annealing cycle for both alloys. Preliminary evaluation of welded Ti–5Al–5Sn–5Zr and Ti–7Al–12Zr showed that good as-welded and welded-and-annealed properties can be achieved. (auth)

21010 (AD-264878) FIRST ANNUAL REPORT ON RESEARCH. (Northwestern Univ., Evanston, Ill. Technological Inst.). July 1961. Contract SD67. 86p.

A compendum of reports is presented concerning active research projects. Included are reports on x ray studies of defects in solids, optical and electrical properties of compound semiconductors, ultra thin layers of metal single crystals, Fermi surfaces in metals, interferometry of dimensional changes in solids, semiconducting gray tin, work function phenomena and dislocations in solids, compounds with Ge double bonds and Si transition metal bonds, microwave investigations of semiconductors and magnetic materials, rheology of polymers, synthesis and solid state reactions of metal complexes, structure and the strength properties of clays, interaction of imperfections and the deformation mechanism, lattice imperfections related to mechanical and physical properties, lattice imperfections produced by electron irradiation, quenching, and low-temperature deformation, surface chemistry of metals and oxides, stress distribution in visco-elastic media—thermal stress problems, low-temperature specific heats of alloy phases, rate studies of very rapid chemical and physical processes, and phonon bombardment and the conductivity of crystal phosphors. (auth)

21011 (AD-264988) INVESTIGATION OF THE EFFECT OF ULTRA RAPID QUENCHING ON METALLIC SYSTEMS, INCLUDING BERYLLIUM ALLOYS. Progress Report, June 1 through September 30, 1961. C. B. Jordan (Electro-Optical Systems, Inc., Pasadena, Calif.). Oct. 15, 1961. Contract AF33(616)-8011. 13p. (EOS-1650-4M-2)

Progress is reported of an investigation of the effect of ultra-rapid quenching on certain alloys of Be. The experimental techniques previously developed were applied with only minor modifications to alloys of the systems Be–O, Be–Al, Be–Si, Be–Sc, Be–Ni, Be–Cu, and Be–Zn. No changes in phase appeared to be induced by ultra-rapid quenching in most of the alloys tested, although a shift of lattice parameter was observed in several. Definite phase changes appeared to be induced in one Be–Cu alloy and in two Be–Ni alloys, but these results are subject to further confirmation. (auth)

21012 (AD-265328) THERMOELECTRICITY QUARTERLY PROGRESS REPORT NO. 2, FEBRUARY 11, 1961–MAY 11, 1961. (Westinghouse Electric Corp. Research Labs., Pittsburgh). May 11, 1961. Contract NOBS-84317. 172p.

A survey of the cubic compounds was continued. The addition of Au to bismuth antimony telluride resulted in a better thermoelectric element. This material has a significantly higher differential efficiency than ZnSb, and was added to the efficiency charts. The exact nature of this compound was not determined. A large number of compounds having the zinc blende or chalcopyrite structures were investigated. None of the compounds having these structures appear to have any promise as thermoelectric elements. Scientific work on MnTe resulted in an improved thermoelectric material Li.04Mn.96Te and permitted the extension of the p-type efficiency chart to 1400°K to match CeS1.38. (auth)

21013 (AD-266094) RARE EARTH CHALCOGENIDES. Technical Progress Report, April 1, 1961 to June 1, 1961. (Pittsburgh. Univ.). June 21, 1961. Contract NObs 77068. 5p.

Synthesis of pure Ce_2S_3 by reacting CeO_2 with CS_2 at temperatures from 800 to 1100°C produced a material which failed to agree with ASTM x-ray data for Ce_2S_3. The CeO_2 was compacted so that synthesization and sintering occurred simultaneously. The volume, density, and resistivities of the compacts were measured. (auth)

21014 (AD-266097) RARE EARTH CHALCOGENIDES. Technical Progress Report, September 1, 1960 to November 30, 1960. (Pittsburgh. Univ.). Dec. 1, 1960. Contract NObs-77068. 4p.

Attempts to synthesize Ce_2S_3 by doping were studied. Doping CeO_2 with various additives failed to reduce the resistivity below 1000 megohm/cm. Graphite additions produced a mechanical mixture which had a lower resistivity. Attempts were made to prepare Ce_2S_3 by utilizing H_2S (1200 to 1400°C) and CS_2 (750 to 850°C) as reducing agents in a SiC tube furnace. Ce_2O_2S was synthesized along with various unidentified compounds. X-ray diffraction pattern data were obtained. (auth)

21015 (AD-266116) RARE EARTH CHALCOGENIDES. Quarterly Report No. 2, October 1 to December 31, 1960. (Research Chemicals, Inc., Burbank, Calif.). Contract NObs-84088. 4p. (RC-164)

The thermoelectric properties of rare earth compounds containing S, Te, and Se are being investigated. A total of 45 chalcogenide compounds was prepared. Various Gd, La, Y, Sm, Yb, Er, and Pr selenides; Gd and Y tellurides; and Gd and Y sulfides were prepared. A mixed Y-Gd selenide was also synthesized. Resistivity and Seebeck voltages were determined, and x-ray diffraction analysis was made. La and Sm selenides were isostructural with the Gd compound. Neither the Gd telluride nor sulfide appeared promising as the selenide. (auth)

21016 (AD-266140) EVALUATION OF THE PRODUCIBILITY OF TWO NEW TITANIUM BASE SHEET ALLOYS, Ti–7Al–12Zr AND Ti–5Al–5Zr–5Sn. Bi-Monthly Report No. 9, July 1, 1961–August 31, 1961. M. Scott and T. Vretas (Republic Steel Corp. Titanium

Research Lab., Canton, Ohio). Sept. 6, 1961. Contract NOas 60-6035-C. 15p.

A study was made of the effect of cooling rate upon mechanical properties of the Ti–7Al–12Zr alloy. Test results showed that slow cooling from 1650, 1550, 1525, and 1100°F developed low tensile ductility and high minimum bend radius (MBR) values, but no appreciable change in tensile or yield strength values. Removal of 0.006 in. appeared to restore tensile ductility but not MBR values. Reheating slow cooled sheet product to 1550°F for 45 min and air cooling restored original MBR values to 4.0 to 5.5T. Microstructure examination of material as mill processed and that reannealed at 1550°F showed a significant difference in grain structure. Electron microscope examination of the grain boundaries did not reveal any precipitate which could account for the poor ductility. (auth)

21017 (AE-68) QUANTITATIVE DETERMINATION OF POLE FIGURES WITH A TEXTURE GONIOMETER BY THE REFLECTION METHOD. Manfred Moeller (Aktiebolaget Atomenergi, Stockholm). Mar. 1962. 16p.

For different slit systems of a modern texture goniometer (type Siemens) the x-ray intensity reflected from textureless plane samples was measured as function of the tilt angle φ and Bragg angle Θ. The intensity curves obtained generally enabled quantitative and almost complete pole figure determinations to be made with only one reflection recording, even for materials with high line density. Investigations on rolled uranium sheet with CuK_α radiation showed that for reliable chart records up to $\varphi \approx 70°$ on reflections with an angular separation of only $\Delta(2\Theta) = 0.7°$, the vertical receiving slit must be limited to at least 1 mm when using a horizontal main slit of 0.5 mm. Though in thir case the intensity dropoff resulting from defocusing from the flat sample surface is considerable even at small tilt angles, a correction of intensity is possible also at large angles within an accuracy of ±5%. Moreover, different pole figures for one material can be compared quantitatively, without constant slit settings and recording conditions being necessary, if the intensity values of the contour lines are always referred to the background radiation. (auth)

21018 (AFOSR-1416) DRIFT MOBILITIES OF ELECTRONS AND HOLES AND SPACE-CHARGE-LIMITED CURRENTS IN AMORPHOUS SELENIUM FILMS. Technical Note No. 5. J. L. Hartke (Illinois. Univ., Urbana. Electrical Engineering Research Lab.). Sept. 1, 1961. Contract AF 49(638)-417. 119p. (AD-267838)

The results of drift mobility and space-charge-limited current measurements made on 20 micron thick films of amorphous selenium were interpreted using the band model of a semiconducting solid with impurity or imperfection levels in the forbidden energy region between the conduction and valence bands. Drift mobilities were measured in the 220 to 300°K temperature range by determining the time of transit across the films of carriers which were photoinjected at one surface by 10^{-9} second light pulses. The drift mobilities at 300°K were 0.165 cm^2/volt sec for holes and 7.8×10^{-3} cm^2/volt sec for electrons. The temperature dependence of hole mobility was $\exp(-0.14\ ev/kT)$, and that of electrons was $\exp(-0.285\ ev/kT)$. The results, which agreed well with those of Spear, indicated that approximately 10^{19} cm^{-3} electron traps were present in a 0.285 ev region just below the conduction band edge, and that about 10^{21} cm^{-3} hole traps occupied a 0.14 ev portion of the gap immediately above the valence band edge. It was postulated that the shallow traps were due to imperfections. Electron drift mobilities were reduced by a factor of three when 0.5 mole % arsenic was added to the films, and were about an order of magnitude smaller than those measured in pure films when 2 mole % of arsenic was added. Their temperature dependence was unchanged, suggesting that the arsenic increased the concentration of imperfections which produce shallow electron traps. Pulse heights of the drifting carriers were used to determine the carrier ranges. Hole ranges were $2\text{-}4 \times 10^{-5}$ cm^2/volt, and exhibited no observable temperature dependence, suggesting that the number of hole capture centers was relatively temperature independent. Electron ranges were $1\text{-}2 \times 10^{-7}$ cm^2/volt at 300°k and decreased with decreasing temperature, suggesting that the number of electron capture centers was temperature dependent. Gold and tellurium electrodes were used to inject holes into amorphous selenium, producing space-charge-limited currents at high fields. The observed currents indicated hole capture centers distributed uniformly in the gap for electron energies less than 1 ev above the valence band edge. The densities of these levels were 10^{15} cm^{-3} ev^{-1}, and the width in energy of the distribution was 0.15 to 1 ev. Electrical conductivities of 10^{-14} to 10^{-16} ohm^{-1} cm^{-1} were obtained at low fields, and suggested that the material was nearly intrinsic. The levels in the gap would thus have to be neutral to avoid strongly extrinsic conductivity. The lowest value of conductivity agreed well with values extrapolated from conductivities of liquid selenium. Drift of photoinjected carriers in the presence of space-charge-limited currents was used to probe the electric field. The general spatial dependence was that expected of space-charge-limiting by holes, but could not be explained quantitatively, possibly due to the nature of the techniques used. (auth)

21019 (ARF-2212-5) DEVELOPMENT OF DUCTILE BERYLLIUM COMPOSITES. Bimonthly Report No. 5, September 18, 1961–November 17, 1961. Frank A. Crossley (Illinois Inst. of Tech., Chicago. Armour Research Foundation). Nov. 17, 1961. Contract NOw-61-0370-c. 11p. (AD-266424)

Further efforts directed to the development of ductile composites consisting of Be particles in a ductile matrix of compositions selected from the Al–Ag system are reported. Efforts are being directed toward making relatively large ($2\frac{1}{2} \times 1\frac{1}{4} \times 1\frac{1}{4}$ in.) compacts from which specimens will be prepared for tensile test evaluation. (auth)

21020 (ARF-8203-18) STUDIES OF THE BRITTLE BEHAVIOR OF CERAMIC MATERIALS. Report No. 18 (Quarterly Report No. 2) February 1, 1962 to April 30, 1962. N. A. Weil, ed. (Illinois Inst. of Tech., Chicago. Armour Research Foundation). May 1962. Contract AF33(616)-7465. 144p.

Activities are reported in tasks concerning the effects of structural size, effects of strain rate, effects of nonuniform stress fields, effects of microstructure, internal friction, and lattice defects, effects of surface energy in brittle fracture, fracture mechanics, impurity effects, static fatigue, effects of thermal-mechanical history, surface active environmental effects, dislocation of polycrystalline ceramics, crack propagation, rheotropic behavior, and porosity effects. (J.R.D.)

21021 (ARL-240) OXIDATION OF TANTALUM AT 300-550°C. Per Kofstad (Sentralinstitutt for Industriell Forskning, Blindern, Norway). Nov. 1961. 63p. (SI-Publ-338)

The oxidation behavior of tantalum at 300 to 550°C was studied. The work comprises gravimetric oxidation rate measurements and x-ray diffraction, electron diffraction,

electron microscopy, metallographic and microindentation hardness studies of the oxidized specimen. Direct x-ray diffraction and metallographic observations were also made on specimens during oxidation. The oxidation constitutes oxygen dissolution in the metal, formation of the metallic oxide phases TaO_y and TaO_z, and formation of Ta_2O_5. The relative importance of the various part-processes involved in the oxidation is a function of temperature, oxygen pressure, and time of oxidation. Initial oxidation below 450°C conforms with a logarithmic oxidation. This is interpreted in terms of a rate-determining nucleation and formation of the metallic oxide phases. Over longer periods and during initial oxidation at higher temperatures the oxidation is approximated by a parabolic oxidation behavior which mainly constitutes a rate-determining oxygen dissolution in the metal and associated metallic oxide formation. Above 450°C the initial approximate parabolic oxidation is followed by a breakaway oxidation which is associated with Ta_2O_5-formation. The breakaway oxidation is interpreted in terms of an oxygen chemisorption equilibrium followed by a rate-determining reaction governed by nucleation and growth of Ta_2O_5-nuclei. (auth)

21022 (ASD-TDR-62-25(Pt.I)) INVESTIGATION INTO THE TUNGSTEN-RICH REGIONS OF THE BINARY SYSTEMS TUNGSTEN–CARBON, TUNGSTEN–BORON AND TUNGSTEN–BERYLLIUM. PART I, TUNGSTEN–CARBON EQUILIBRIUM SYSTEM. H. J. Goldschmidt and J. A. Brand (Birmingham Small Arms, Ltd., Birmingham, Eng.). Mar. 1962. Contract AF61(052)-306. 41p.

A study was made of the W-rich part of the W–C system principally by x-ray-diffraction techniques. It was shown that the solid solubility of C in W is finite, attaining a maximum of approximately 0.3 at.% at the eutectic temperature but decreasing rapidly to 0.05 at.% C near 2000°C and to insignificant amounts at lower temperatures. The precipitating phase is W_2C. This has a second allotropic form of cubic (NaCl type) structure, stable at very high temperatures. (auth)

21023 (ASD-TR-61-194) EFFECTS OF SEVERE THERMAL AND STRESS HISTORIES ON MATERIAL STRENGTH–RATE PROCESS THEORY APPROACH—AISI 301 EXTRA HARD, PH 15-7 Mo RH, RENÉ 41, 7075-T6. C. D. Brownfield and D. R. Apodaca (Norair. Div. of Northrop Corp., Hawthorne, Calif.). June 1961. Contract AF33(616)-5769. 149p.

Methods and design data were developed for estimating the design strengths of three high temperature alloys under conditions of severe temperature histories. The rate-process based parameter T(C + log t) was applied with good results to the thermal exposure strength degradation of two high-strength stainless steels, AISI Type 301, Extra Hard temper and PH 15-7 Mo, RH conditions. The same parameter gave indication of applying to the super alloy René 41 within a limited exposure temperature range. Stress applied during thermal exposure was sampled and found to have little effect in promoting degradation of basic material strength, in most cases. In René 41, stress during thermal exposure in air contributed to surface deterioration which caused large reductions in ultimate tensile strength and tensile elongation. (auth)

21024 (ASD-TR-61-383) GRAIN BOUNDARY SLIDING IN ALUMINIUM AND ITS BINARY ALLOYS. Arthur W. Mullendore, Yoichi Ishida, and Nicholas J. Grant (Massachusetts Inst. of Tech., Cambridge). Aug. 1961. Contract AF33(616)-5926. 32p.

A study was made of grain boundary sliding in Al–Mg bicrystals to test a mechanism for sliding proposed in previous work. The mechanism relates sliding to slip crossing grain boundaries. An investigation was also made of the effect of a second phase existing in various distributions on grain boundary sliding. Al–3% Cu was used for this study. It was found that for tests at similar strain rates very large differences in grain boundary sliding rate resulted from differences in heat treatment. The nature of stresses at the triple points of sliding grain boundaries was also investigated using tricrystals of Al and Al–Mg. (auth)

21025 (ASD-TR-61-499) INVESTIGATION OF THE EFFECTS OF RAPID LOADING AND ELEVATED TEMPERATURES ON THE MECHANICAL PROPERTIES OF COMPRESSIVE AND COLUMN MEMBERS. P. R. Dioguardi and R. D. Lloyd (Marquardt Corp., Van Nuys, Calif.). July 31, 1961. Contract AF33(616)-7345. 132p.

The short-time tensile and compressive properties were evaluated for René 41 and Haynes 25 sheet alloys at room temperature and at 800 to 2200°F. Tests conducted at various strain rates (0.00001 to 0.1 in./in./sec) produced significant differences in strength, particularly at elevated temperatures. Creep properties, both tensile and compressive, were determined for the same alloys at 1600 to 2200°F and times up to 15 minutes. At the higher stress levels, creep rates became very rapid and considerable amounts of plastic strain occurred in times of 1 sec or less. A preliminary study was conducted on the use of programmed, forced strain rate tests to predict short time creep properties. (auth)

21026 (DC-59-6-224 and Add.) MILESTONE II, JOB NO. 50998, TASK 434411 — PHOTOSTRESS TECHNIQUES. Wayne E. Nickola (General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati). June 19, 1959. Includes Addendum: July 14, 1959. Contract AT(11-1)-171. 30p.

Photostress and photoelastic techniques of stress analysis are discussed. Errors in Photostress techniques were studied, and found to be caused by bending corrections, slip or relaxation, edge effect, and thickness effects in high strain gradient areas. Time and effort were also directed toward perfecting the technique of bonding Photostress plastic to curved surfaces, the application of Photostress for analysis of a dynamic strain field, and improving the technique of photographing strain patterns. (M.C.G.)

21027 (DC-59-12-216) P-103 PRESSURE VESSEL STRAIN CONCENTRATIONS. W. E. Nickola (General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati). Dec. 30, 1959. Contract AT(11-1)-171. 42p.

Results are presented of an investigation of the effects of both reamed and threaded holes in a flat plate type Inconel-X specimen subjected to tensile loading. Nine specimens were tested at each of the following temperature conditions: room temperature, 800, 1000, and 1200°F. Of the 9 specimens tested at each temperature, 3 had no holes, 3 had reamed holes, and 3 had threaded holes. All specimens were loaded to rupture. An attempt was made to determine the load required to produce 0.2% yield at the edge of the holes in the perforated room temperature test specimens. This was done by bonding a sheet of photostress plastic to one face of the specimens and making readings with a small-field reflective polariscope. (auth)

21028 (DC-60-1-108) STRESS OXIDATION OF 80Ni-20Cr FUEL ELEMENTS. A. J. Butterfield (General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati). Jan. 15, 1960. Contract AT(11-1)-171. 25p.

A discussion is presented of the oxide attack on 80Ni–20Cr fuel ribbon. The data on which the major portion of the discussion is based were taken from metallographic examinations of fuel elements tested in the HT-1 hole

facility at the MTR and fuel elements tested in the GDF-I Burner Rigs. The data show the oxide attack to be a strong function of temperature while stress and time appear to have smaller effects. In addition, the discussion includes a description of the oxide which forms as a result of operation in an atmosphere containing the products of hydrocarbon combustion. Oxide penetration data taken from fuel element tests are presented. (auth)

21029 (DC-60-1-146) FRICTION AND WEAR OF METALLIDED SURFACES. C. F. Zapf (General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati). Jan. 19, 1960. Contract AT(11-1)-171. 18p.

Results of friction and wear tests are presented showing the beneficial effects of boriding on the surfaces of Inconel X and Hastelloy X. Beryllided surfaces of these same alloys failed to stand up under the 6000 psi bearing stresses which were imposed during these tests at temperatures to 1200°F. These tests were of short duration since the data were collected in approximately five hours. During this time friction readings were taken at predetermined points as the specimen temperature was raised to 1200°F and then cooled to 150°F. (auth)

21030 (DC-60-3-110) AN APPARATUS FOR EVALUATING THE THERMAL STRESS RESISTANCE OF VARIOUS HIGH TEMPERATURE MATERIALS. F. M. Donovan, Jr. (General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati). Mar. 11, 1960. Contract AT(11-1)-171. 31p.

Equipment and technique for imposing and measuring temperature gradients in 3.0 inches diameter flat disks are described. The equipment is designed to impose transient temperature gradients of variable magnitude within the temperature range of 2800°F to room temperature. The equipment is also designed to impose cyclic temperature gradients on the test specimen within the above temperature range. Provisions are made for detecting cracks in the test specimen when they occur. Operating procedures, limits, and some test results are included. (auth)

21031 (DC-60-8-25) AN EVALUATION OF A COATED REFRACTORY METAL. S. Baranow (General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati). Aug. 4, 1960. Contract AT(11-1)-171. 4p.

Studies were made to determine the lifetime of Zn and Zn-4% Al coated Nb samples in the temperature range 1900 to 2300°F. It was found that the chief limitation to the use of Zn coated Nb is the ignition temperature of the coating which lies between 2000 and 2100°F. The presence of Al suppressed the ignition of the zinc up to 2300°F. Results of static oxidation tests are presented in tabular form. (M.C.G.)

21032 (D1-82-0163) ULTRASONIC STUDY OF THE CUBIC-TETRAGONAL PHASE CHANGE AND THE CURIE TEMPERATURE OF SINGLE CRYSTAL $SrTiO_3$. Reuben S. Krogstad and Robert W. Moss (Boeing Scientific Research Labs., Seattle). Mar. 1962. 12p.

An investigation is described in which attenuation and sound velocity as a function of temperature were measured over a frequency range 10 to 150 mc/sec on single crystal specimens of $SrTiO_3$ along three principal crystallographic directions at room temperature to that of liquid He. It was found that ultrasonic attenuation in $SrTiO_3$ exhibits two dominant maxima; one starting at 110°K which is attributed to the scattering of phonons at the interfaces between cubic and tetragonal domains which coexist in a narrow temperature range below this point, and a second below about 48°K which is ascribed to ferroelectric dielectric losses. (J.R.D.)

21033 (HW-70151) THE ACTIVATION ENERGIES FOR CREEP OF ZIRCALOY-2. J. J. Holmes (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). Mar. 1962. Contract AT(45-1)-1350. 26p.

The activation energies for creep of Zircaloy-2 at stresses between 20,000 and 30,000 psi at 50 to 500°C were determined by the temperature cycle method. Results show that at least three creep processes, each characterized by a different activation energy, are operative in the range of stresses and temperatures studied. Between 50 and 285°C, the upper limit depending on stress, creep is controlled by a combination of dislocation climb and one or more intersection processes. Above 285°C creep is controlled dislocation climb which is characterized by an activation energy of 58,500 cal/mole. Superimposed on the climb and intersection processes is a third process characterized by an activation energy peak. The mechanism producing the peak is rationalized in terms of a dislocation pinning mechanism. (auth)

21034 (HW-SA-2583) A STUDY OF PROPERTIES RELATED TO FEASIBILITY OF USING BORON STEEL FOR NUCLEAR REACTOR THERMAL SHIELDING (thesis). George Toralf Haugland (General Electric Co. Hanford Atomic Products Operation, Richland, Wash.). 1962. Contract [AT(45-1)-1350]. 161p.

Submitted to Univ. of Idaho, Moscow.

A study was made to determine if it is feasible to use hot rolled boron steel plate for thermal shielding in nuclear reactors. Information was also sought to permit preparation of specifications for procurement of boron steel plates and to evaluate fabrication techniques. Previous work was reviewed. Physical, mechanical, chemical, and thermal properties and radiation shielding effectiveness were determined. Results of tests on approximately 200 tons of boron steel plate indicated that it has adequate properties for use in thermal shielding applications. Fabrication techniques and improved shield cooling methods were developed. (M.C.G.)

21035 (NAA-SR-6267) HYDROGEN PERMEATION OF OXIDE FILMS ON ZIRCONIUM. Tennyson Smith (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). May 15, 1962. Contract AT(11-1)-Gen-8. 71p.

To obtain a better understanding of the solid state chemistry involved in the transfer of hydrogen through zirconium dioxide films on zirconium, the rates of hydrogen permeation were studied. The rate of hydrogen permeation of oxide films on crystal bar zirconium samples (cylindrical with hemispherical ends) was found to be inversely proportional to the film thickness (100 to 2500Å), exponentially related to the temperature (200 to 700°C), and related to the hydrogen pressure (1 to 860 mm Hg) by the function [bP/(1 + bP)]. An empirical equation relating the hydrogen permeation rate r with film thickness δ, temperature T, and hydrogen pressure P is $[r = (k_0/\delta) \cdot (bP/1 + bP) \exp(-Q/RT)]$, where $b \approx 4.6 \times 10^{-3}$, and k_0 (10^{-14} to 5 moles H_2/cm-sec) and Q (8 to 43 kcal/mole) have values which depend on the experimental conditions. The permeation rate, r, is expressed in moles H_2/cm^2-sec. A theoretical interpretation is that the rate of hydrogen permeation is controlled by interstitial diffusion of molecular hydrogen through the film, and that anion cation vacancies must be present to allow passage from interstice to interstice. (auth)

21036 (NMI-9235) REFRACTORY METALS PHASE DIAGRAMS. Quarterly Progress Report for the Period April 1, 1961 to June 30, 1961. E. J. Rapperport (Nuclear Metals, Inc., Concord, Mass.). Aug. 4, 1961. Contract AF33(616)-7157. 19p.

Progress is reported toward determining phase diagrams

for the alloys W–Rh, W–Ir, Ta–Zr, Ta–Ir, Ta–Rh, Mo–Os, and Mo–Hf–Re. (J.R.D.)

21037 (NP-11614) EVALUATION OF A HIGH STRENGTH COLUMBIUM ALLOY (AS-55) FOR ALKALI METAL CONTAINMENT. Quarterly Report No. 1, November 25, 1961 to February 25, 1962. (General Electric Co. Flight Propulsion Lab. Dept., Cincinnati). Contract NAS 3-2140. 56p.

An investigation was undertaken to obtain additional documentation of the AS-55 niobium base alloy as an alkali metal containment material for nuclear turboelectric space power systems. Procurement of materials was completed. All the electrode sections required for the program were cold pressed and vacuum sintered at 2800°F. Billets from two ingots were successfully forged, warm rolled, and subsequently cold rolled. A capsule heater which was constructed to a preliminary design is being evaluated. (M.C.G.)

21038 (NP-11665) PROGRESS REPORT NO. 14 [ON PROPERTIES OF CARBONS AND GRAPHITES], FEBRUARY 1, 1962 TO APRIL 30, 1962. J. F. Andrew, N. Juul, H. E. Strauss, and T. Tsuzuku (Buffalo. Univ.). May 15, 1962. Contract AF33(616)-7791. 25p.

Studies are being made of the elastic properties of carbons and graphites at room and high temperatures in relation to some of the fabrication and structural variables and of the heat conduction and diffusivity of graphites at high temperatures. A satisfactory performance of the high temperature elasticity equipment with new electronics was obtained. The results of measurements of the dynamic modulus and internal friction coefficient obtained at room temperature in a comparison of a conventional graphite, pyrolytic graphite, and glassy carbon are presented. A sensitivity of the internal friction to the presence of internal defects introduced by neutron irradiation was observed. Detailed high-temperature studies of heat conductivity were carried out on a soft filler-hard binder carbon. (M.C.G.)

21039 (NP-11671) ENGINEERING PROPERTIES OF POTASSIUM. Quarterly Report No. 6, January 1 through March 31, 1962. Alexis W. Lemmon, Jr. (Battelle Memorial Inst., Columbus, Ohio). Apr. 30, 1962. Contract NAS 5-584. 18p.

The thermodynamic and transport properties of potassium are being determined at 900 to 2100°F. Measurements are being made on the viscosity of the liquid and the vapor pressure. Modifications of the apparatus for purification of potassium by distillation, gettering of the charge, and performing the fifth distillation at pressures as low as 5×10^{-4} mm Hg resulted in oxygen contaminations as low as 35 ppm. Vapor pressure data were found to compare closely with those previously reported. The Nb-1 Zr alloy capsules for the specific heat measurements were completed, filled with potassium, sealed, and radiographed. Assembly of the vapor viscometer was continued. Fabrication and assembly of the P-V-T apparatus was also continued. (M.C.G.)

21040 (NP-11698) TRANSFORMACIONES EN ALEACIONES BETA EN EL SISTEMA COBRE–ESTAÑO. INFORME NO. 63. (Beta Transformations of Copper–Tin Alloys. Report No. 63). J. Kittl and A. Leyt (Argentina. Comisión Nacional de Energía Atómica, Buenos Aires). 1962. 18p.

Alloys in the beta, beta + gamma, and gamma phases were studied. The appearance of a structure formed on quenching from beta + gamma was explained and observations in quenched specimens from the beta phase showed that at 90°C a reaction accompanied by dilatation starts. Theory of phase transformations is discussed along with similarities with transformation of other phase alloys. (J.R.D.)

21041 (TID-15663) INVESTIGATION OF SPECIFIC VOLUMES OF LIQUID METALS AND ALLOYS. Report No. 1, April 1, 1961 to July 31, 1962. Frank A. Kanda, Douglas V. Keller, Patrick Brown, and Robert Faxon (Syracuse Univ., N. Y.). May 1962. Contract AT(30-1)-2731. 35p.

Apparatus and systems for use in determining densities of liquid metals and for determining heat capacities are described. Preliminary studies of liquid metal surfaces are also described. Results are included on the densities of Al, Sn, and Bi. (J.R.D.)

21042 (WAL-TR-851.2/1) THE SPECTRAL EMISSIVITY AND TOTAL NORMAL EMISSIVITY OF COMMERCIAL GRAPHITES AT ELEVATED TEMPERATURES. Albert F. Grenis and Albert P. Levitt (Watertown Arsenal Labs., Mass.). May 1962. 23p.

The spectral emissivities, at an effective wavelength of 0.65 microns, and total normal emissivities, were determined for both machined and polished surfaces of the graphites Great Lakes Carbon H1LM, Great Lakes Carbon H3LM, and Speer 7100. The spectral emissivities were investigated from 1000 to 3000°C. For machined surfaces, the spectral emissivity decreased with increasing temperature from 0.87 to 0.81 for H1LM; 0.87 to 0.83 for H3LM; and 0.87 to 0.78 for Speer. For polished surfaces, the spectral emissivity appeared to remain constant with increasing temperature and the mean value was found to be 0.855 for H1LM; 0.777 for H3LM; and 0.820 for Speer 7100. The total normal emissivities were investigated from 1600 to 3000°C. For machined surfaces, the mean value of the total normal emissivity was found to be 0.852 for H1LM; 0.852 for H3LM; and 0.847 for Speer 7100. For polished surfaces, the mean value of the total normal emissivity was found to be 0.802 for H1LM; 0.808 for H3LM; and 0.800 for Speer 7100. (auth)

21043 (AEC-tr-5103) MINUTES OF THE FRENCH-CANADIAN DISCUSSION ON THE BEHAVIOUR OF FISSION GASES IN URANIUM OXIDE, SEPTEMBER 26-27, 1961. (France. Commissariat a l'Énergia Atomique. Centre d'Études Nucléaires, Saclay). Translated by A. L. Monks (Oak Ridge National Lab., Tenn.) from report DM/CS/D/7027, Jan. 29, 1962. 15p.

Experiments on the behavior of fission gases in irradiated UO_2 are discussed from the point of view of physical mechanisms and application in reactors using this fuel. Results are presented in tabular form. The effects of burn-up ratio, temperature, thermal conductivity, specific surfaces, microstructure of the sinterings, and the O/U ratio were studied. (M.C.G.)

21044 (AEC-tr-5127) THE ZIRCONIUM-RICH PHASES IN THE Mg–Zr SYSTEM. Hans-Joachim Taschow and Franz Sauerwald. Translated from Z. anorg. u. allgem. Chem., 307: 123-26(1961). 16p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 15, abstract no. 14788.

21045 (AEC-tr-5138) DETERMINATION OF THE GLIDE ELEMENTS OF HEXAGONAL METALS USING THE ASTERISM IN LAUE PHOTOGRAPHS AND APPLICATION TO A STUDY OF BERYLLIUM DEFORMATION AT HIGH TEMPERATURE. P. Bastien and P. Pointu. Translated by A. L. Monks (Oak Ridge National Lab., Tenn.) from J. Nuclear Materials, 5: 101-8(1962). 22p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 16, abstract no. 12139.

21046 (AEC-tr-5171) DIFFUSION OF TRI- AND QUADRIVALENT FISSION PRODUCT IONS IN UO_2. F. Schmitz and R. Lindner. Translated from Z. Naturforsch., 16a: 1096-7(1961). 5p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 16, abstract no. 10602.

21047 (EURAEC-17) RESEARCH INTO THE DIFFUSION OF INERT GASES IN SOLID BODIES. First Quarterly Report (July 1 to September 30, 1960). (Hahn-Meitner-Institut für Kernforschung, Berlin). Oct. 26, 1960. Work performed under United States–Euratom Joint Research and Development Program. Contract [019-60-7RDA]. 8p. A Translation.

Work was almost entirely confined to the designing and construction of the apparatus and the procurement of the parent substances. As a result of the preliminary work carried out in the first half of the year 1960, there were available at the end of the quarter for the systems to be examined (potassium halide-argon, uranium oxide-xenon and uranium carbide-xenon) a number of suitable specimens and usable pieces of apparatus. The initial results obtained with potassium halides showed that this system was practicable. The potassium salts of aliphatic carbonic acids did not appear to be suitable for the projected diffusion research. With the apparatus for the uranium oxide and uranium carbide systems, preliminary tests and standard measurements were able to be carried out. (auth)

21048 (EURAEC-18) RESEARCH INTO THE DIFFUSION OF INERT GASES IN SOLID BODIES. Quarterly Report No. 2 (October 1 to December 31, 1960). (Hahn-Meitner-Institut für Kernforschung, Berlin). Jan. 17, 1961. Work Performed under United States–Euratom Joint Research and Development Program. Contract [019-60-7RDA]. 12p. A Translation.

Results were obtained from tests carried out on single crystals of KF. For pressed tablets from pulverulent KF, the heating curve obtained was different from that obtained in the case of single crystals. The first measurements on UO_2 and UC systems were effected. On the strength of results of the measurements, both the equipment and method were improved. It was found that the fission inert gas activity obtainable in ThO_2 on irradiation in the BER is sufficient to permit the carrying-out of diffusion tests. (auth)

21049 (EURAEC-121) DIFFUSION OF FISSION GASES IN NUCLEAR FUELS—RESEARCH INTO THE DIFFUSION OF INERT GASES IN SOLID BODIES. Quarterly Report No. 4, April 1 to June 30, 1961. (Hahn-Meitner-Institut für Kernforschung, Berlin). July 12, 1961. Work performed under United States–Euratom Joint Research and Development Program. Contract 019-60-7RDA. 9p. A Translation.

Research into argon diffusion in potassium halides by various systems was pursued. Initial tests for the elucidation of the atomic diffusion system were carried out. An apparatus was constructed which permits measurements up to 1700°C. The diffusion equation was solved with the aid of the Siemens 2002 digital computer for spherical, cylindrical, and square samples. Diffusion of xenon in uranium dioxide, thorium dioxide, and uranium carbide was studied. (M.C.G.)

21050 (NP-tr-901) THE FORMATION OF $UC_{1-x}O_x$. Shingo Namba, Shosuke Imoto, and Tadao Sano. Translated by S. G. Brickley (U.K.A.E.A. Atomic Energy Research Establishment, Harwell, Berks, Eng.) from Nippon Genshiryoku Gakkaishi, 3: 457-61(1961). 19p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 15, abstract no. 27532.

21051 THE CRYSTAL STRUCTURE OF ZrAl. J. F. Spooner and C. G. Wilson (Royal Military Coll. of Science, Shrivenham, Swindon, Wiltshire, Eng.). Acta Cryst., 15: 621-2(June 1962). (In English)

The crystal structure of the intermetallic phase ZrAl was determined from x-ray powder films of impure specimens. Several alloys were prepared by arc melting suitable quantities of the pure metals in argon to give a composition of 50 at. % for each component, but all the films showed the presence of considerable quantities of the neighboring phase Zr_2Al_3. According to the phase diagram for the zirconium–aluminum system, the stable composition range for ZrAl is only a few at. % and furthermore the alloy is unstable above 1250°C. It is apparent that the preparation of a pure specimen of ZrAl is difficult, and metallographic examination of the polished specimens showed the presence of two phases, Zr_2Al_3 and ZrAl. The sharply defined lines belonging to the Zr_2Al_3 phase, whose structure is now known, were rejected. Apart from a few unidentified lines, the remaining lines were indexed on the basis of an orthorhombic unit cell of dimensions similar to that given by Edshammar for HfAl; the dimensions found were a = 3.359 ± 0.001, b = 10.887 ± 0.003, and c = 4.274 ± 0.001 Å. (N.W.R.)

21052 CERAMOGRAPHIC TECHNIQUES: I. SINGLE PHASE, POLYCRYSTALLINE, HARD MATERIALS. M. C. Houle and R. L. Coble (General Electric Research Lab., Schenectady, N. Y.). Am. Ceram. Soc. Bull., 41: 378-81 (June 15, 1962).

The preparation of polished sections of hard, single phase, ceramic materials for microscopic examination in reflected light is discussed. Techniques which have proved successful in the grinding, polishing, and etching with a minimum of "pull-outs" of MgO, BeO, UO_2, ZrO_2, Cr_2O_3, and Al_2O_3 are described. Comparisons of variations in techniques are made by means of photomicrographs. The use of hard and relatively dry laps with application of light pressure during grinding and polishing with low nap cloths are recommended. (auth)

21053 SURFACE DIFFUSION STUDIES OF CESIUM ON TUNGSTEN. H. Shelton (Space Technology Labs., Inc., Canoga Park, Calif.). ARS (Am. Rocket Soc.) J., 32: 708-10(May 1962).

Measurements were made on the angular distribution of ions radially accelerated from a 0.001-in. dia. tungsten wire immersed in a cesium atomic beam. Due to surface migration, ions are emitted from the shadowed side of the wire, allowing measurements of the surface diffusion length and the ion lifetime under ion emission conditions and of the surface diffusion coefficient. The surface diffusion lengths under ion emission are about 1 μ. The surface diffusion constant was higher than anticipated and was strongly temperature dependent. Ion lifetimes on the oxygenated tungsten are comparable with those from clean tungsten, but the neutral lifetimes are much larger. This longer neutral lifetime will proportionately reduce the neutral evaporation from any given distribution of coverage on any ion source. (auth)

21054 DIFFUSION AND SOLUBILITY OF IRON IN BERYLLIUM. Gérard Donze, Roger Le Hazif, Françoise Maurice, Daniel Dutilloy, and Yves Adda. Compt. rend., 254: 2328-30(Mar. 26, 1962). (In French)

The solubility limit and the diffusion coefficients of iron in Be were determined between 700 and 1100°C. These results permitted a better understanding of the effect of thermal treatments on the ductility of commercial Be. (tr-auth)

21055 THE THERMODYNAMICS OF TUNGSTEN OXIDES OF VARIABLE COMPOSITION. R. F. Ksenofontova, I. A. Vasil'eva, and Ya. I. Gerasimov (Moscow Univ.). Doklady Akad. Nauk S.S.S.R., 143: 1105-7(Apr. 11, 1962). (In Russian)

The emf of cells of the type Mo, WO_4 (electrolyte with anionic conduction), Fe, $Fe_{0.947}O$, and Mo was measured at 900 to 1100°K in order to determine thermodynamic constants. The comparison electrode was an equilibrium mixture of iron and wustite. A solid solution of 0.85 ZrO_2(0.15 CaO) was used as the electrolyte, since it possesses purely anionic conduction at 600 to 1100°C. The electromotive force and the free energy of the reaction $(2/\delta)\ WO_{x+\delta} = (2/\delta)\ WO_4 + O_2$ varied linearly with temperature. The emf increases with an increasing oxygen content of the oxide. A plot of the isotherm lg P_{O_2} as a function of the composition of the tungsten oxide shows the existence of a two-phase region at 850 to 900°K for values of $\underline{x}$ of 2.72 to 2.89. Above 1000°K there is only a single-phase region. This behavior can be explained either by the oxidation of W(IV) to W(VI) or by the formation of cation vacancies. (TTT)

21056 A STUDY OF IRON–ALUMINUM ALLOYS IN THE Fe_3Al REGION OF COMPOUND FORMATION. R. S. Mints and N. N. Samsonova (Baikov Metallurgy Inst., USSR). Doklady Akad. Nauk S.S.S.R., 143: 1108-11(Apr. 11, 1962). (In Russian)

Iron alloys containing 9 to 16 wt % Al were prepared by vacuum fusion in an induction furnace. The hardness, hot hardness, linear expansion coefficient, and electrical resistance were measured as a function of the Al content. Microstructural analyses on quenched and annealed samples showed the absence of any changes due to transformations of Fe_3Al. All the curves showed definite minima at 14.3 wt % Al (25.8 at.% Al) which is close to the composition of Fe_3Al. The hot hardness curves indicate the existence of a compound at 12.0 wt % Al below 600°C. The heat strength of the Fe–Al alloys increases with increasing aluminum content, and Fe–Al alloys containing 16 to 18 wt % Al as a solid solution in alpha iron possess the highest heat strength. (TTT)

21057 THERMAL EXPANSION OF CERAMIC MATERIALS AT −200° TO 0°C. Maksymilian Burk (Coors Porcelain Co., Golden, Colo.). J. Am. Ceram. Soc., 45: 305-6 (June 1962).

Thermal-expansion coefficients of alumina, magnesia, and beryllia from −200 to +20°C are presented. A quartz tube dilatometer, modified for low temperature, was used for the measurements. (N.W.R.)

21058 TENSILE PROPERTIES OF BINARY TITANIUM–ZIRCONIUM AND TITANIUM–HAFNIUM ALLOYS. A. G. Imgram, D. N. Williams, and H. R. Ogden (Battelle Memorial Inst., Columbus, Ohio). J. Less-Common Metals, 4: 217-25(June 1962). (In English)

The effects on the tensile properties of alloy content and heat treatment for the Ti–Zr and Ti–Hf systems were found to be approximately the same. Strength increased and ductility decreased with additions of up to 40 wt % Zr and Hf. The beta-quenched structures showed considerably higher strengths than the beta-furnace-cooled structures; this was attributed to the nucleation and growth in the beta-furnace-cooled specimens of a relatively low alloy content, weak alpha phase. (auth)

21059 SOME MICROSTRUCTURAL OBSERVATIONS DURING THE THERMAL CYCLING OF ZIRCONIUM. R. H. Johnson (Berkeley Nuclear Labs., Gloucester, Eng.) and R. W. K. Honeycombe. J. Less-Common Metals, 4: 226-34(June 1962). (In English)

A hot-stage microscope was used to investigate the microstructural changes occurring during the thermal cycling of zirconium. Continuous observation of the specimen surface revealed the development of such surface markings as slip, twins, and boundary migration. The relevance of these observations to the anisotropy of thermal expansion is discussed. (auth)

21060 SOME PROPERTIES OF THORIUM MONOCARBIDE AND DICARBIDE. C. P. Kempter and N. H. Krikorian (Los Alamos Scientific Lab., N. Mex.). J. Less-Common Metals, 4: 244-51(June 1962).

The two known carbides of thorium, ThC and ThC_2, were prepared from thorium metal and spectro-grade graphite by arc melting. A quantitative mass spectrographic study of the room temperature gaseous hydrolysis products showed ThC to produce mainly methane and ThC_2 to produce mainly ethane and hydrogen. X-ray powder diffraction, electrical resistivity, and microhardness data are also presented. (auth)

21061 ON THE CONSTITUTION OF ZIRCONIUM–NIOBIUM ALLOY. H. Richter, P. Wincierz, K. Anderko, and U. Zwicker (Metall-Laboratorium der Metallgesellschaft A. G., Frankfurt am Main). J. Less-Common Metals, 4: 252-65(June 1962). (In German)

It was found on investigating the zirconium–niobium system that even when 99.9% pure iodide-zirconium is used the oxygen content of the alloys leads to a distinct ternary character of the phase diagram. In this way the monotectoid point of the binary system is extended over a transformation range, which in the case of alloys made from iodide-zirconium is about 100°C and in the case of alloys made from sponge zirconium is over 200°C. The maximum solubility of niobium in α-zirconium is about 2 wt % and is dependent on the purity of the original material. In sponge zirconium the solubility is less. The lattice constants of α-zirconium are reduced by niobium. It was not possible to establish whether the α-solid solution could be age-hardened. (auth)

21062 TENSILE DEFORMATION OF BERYLLIUM SINGLE CRYSTALS IN VARIOUS ORIENTATIONS BETWEEN 25°C AND 600°C. P. I. Treharne and A. Moore (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). J. Less-Common Metals, 4: 275-85(June 1962). (In English)

Single crystals of predetermined orientation were grown from the melt by a floating zone technique using seeds to nucleate the required orientation. The crystals were prepared from vacuum cast and extruded electrolytic flake. The level of purity obtained is 99.83% and the critical resolved shear stress for basal (0001) slip was measured in tension from 25 to 600°C, in crystals which have deformed only by basal (0001) slip. The critical resolved shear stress for (0001) slip remains constant at 750 psi from 300 to 600°C and increases only × 5 in the range 300 to −196°C. This small rise in critical resolved shear stress contrasts markedly with that found for $(10\bar{1}0)$ slip, which increases by × 9 in the same temperature range from ~1,500 to 13,000 psi. It is concluded that increasing purity reduces the critical resolved shear stress for both (0001) and $(10\bar{1}0)$ slip from 25 to 600°C by ~ × 2. It is suggested that the independence of critical resolved shear stress for both (0001) and $(10\bar{1}0)$ slip with temperature in the range 300 to 600°C implies that the beryllium lattice is hardened by increasing its solute concentration. (auth)

21063 STRAIN-AGEING IN NIOBIUM ALLOYS. W. F. Sheely (Union Carbide Corp., Niagara Falls, N. Y.).

J. Less-Common Metals, 4: 291-300(June 1962). (In English)

Experiments were performed to determine the extent to which substitutional solutes (titanium, zirconium, and vanadium) influence strain-aging reactions of interstitials during tensile testing of niobium. It was found that each of these solutes shifts the strain-aging reaction to a higher temperature than is characteristically observed in unalloyed niobium. This is interpreted as being indicative of a binding between substitutional and interstitial atoms in solid solution, and it is suggested that this binding arises from elastic and, in special cases, electronic interaction. By studying both binary and ternary alloys, the solid-solution strengthening effects of substitutional solutes may be separated from effects of interstitials. (auth)

21064 COMPARISON OF THE HYDROGEN–HAFNIUM AND HYDROGEN–ZIRCONIUM SYSTEMS. L. Espagno, P. Azou and P. Bastien (Ecole Centrale des Arts et Manufactures, Paris). Mém. sci. rev. mét., 59: 182-8(Mar. 1962). (In French)

Comparative study of the H–Hf and H–Zr systems revealed similarities but also certain differences. With respect to the volume of hydrogen absorbed at atmospheric pressure and the reaction kinetics, as well as the expansion of the metal, after hydrogen absorption, the behavior of hafnium and zirconium relative to the gas is similar. On the other hand, expansion-measuring and x-ray crystallographic techniques, although they confirmed these similarities, indicate on the basis of the reaction temperatures a grouping which is contrary to theoretical expectation based on a consideration of the intrinsic properties of the two metals. (auth)

21065 STUDY OF FATIGUE OF ZIRCALOY-2 BY ALTERNATING TORSION AT ROOM TEMPERATURE. M. Levasseur and J. de Fouquet (Laboratoire de Metallurgie Physique, Poitiers, France). Mém. sci. rev. mét., 59: 295-304(Apr. 1962). (In French)

The fatigue behavior produced by alternating torsion of Zircaloy-2 and the influence of the initial condition of the metal on this behavior were studied on small torsion specimens. The fatigue strength was greatest in the annealed condition at 750°C which corresponds to a micrographic structure intermediate between the original extruded condition and the recrystallized condition obtained after annealing at 900°C. The change in the torque/angle of twist diagram during fatigue was approximately the same irrespective of the initial condition of the metal. Comparison of this change with that obtained on drawn and annealed armco iron permits certain observations to be made on the fatigue mechanism of metals. (auth)

21066 DENDRITIC GROWTH OF GRAPHITE FROM MELTS. I. Minkoff and I. Einbinder (Faculty of Mechanical Engineering, Technion, Haifa, Israel). Nature, 194: 765-6(May 26, 1962.).

Observations are reported on the dendritic growth of graphite from Ni–C melts. Ni shot was melted in graphite crucibles, held at 1450°C to saturate the melt, and cooled at a rate of 15°C/min. Large discontinuous plates of primary graphite were observed, separated from eutectic graphite by the α phase. Large growth steps averaging 0.01 mm were observed in the crystal interior, while at the surface smaller steps of 0.001 mm height were measured. No evidence was found for screw dislocations, but systems of concentric circular steps or hexagonal steps were observed. It is concluded that the dendritic graphite grows by repeated nucleation of steps which advance as a series of macro-steps into the liquid. (D.L.C.)

21067 THE SYSTEM $CaO–MgO–ZrO_2–SiO_2$. A. S. Berezhnoi and R. A. Kordyuk. Ogneupory, 27: No. 2, 85-90(1962).

The system $CaO–MgO–ZrO_2–SiO_2$ was studied with stress on its unexplored ternary subsystem $CaO–ZrO_2–SiO_2$, for the purpose of investigating the possibility of utilizing the quaternary system in the production of refractories. The results obtained and available data on the other three ternary subsystems — $CaO–MgO–ZrO_2$, $CaO–MgO–SiO_2$, and $MgO–ZrO_2–SiO_2$ — showed that the quaternary system contains at 1600°C rather considerable concentration fields suitable for the production of refractories. These fields drop sharply with an increase of the temperature to 2000°C, which reveals the negative effect of SiO_2. Only binary combinations of CaO, MgO, and ZrO_2 or ternary combinations containing less than 5% of the third oxide are suitable for the production of refractories for performance at 2000°C. (OTS)

21068 THE DUCTILE-BRITTLE TRANSITION IN BODY-CENTRED CUBIC TRANSITION METALS. A. A. Johnson (Imperial Coll. of Science and Tech., London). Phil. Mag. (8), 7: 177-96(Feb. 1962).

The significance of the parameters σ_i and k_y in Petch's empirical relation $\sigma_y = \sigma_i + k_y d^{-\frac{1}{2}}$ between yield stress and grain size is discussed. It is concluded that σ_i is made up of two terms σ_i (L) and σ_i (I). The first, σ_i (L), represents the stress required to propagate a Luders band through a single crystal having no lattice friction stress. It is a function of the stress, σ_d, required to unpin a dislocation from its impurity atmosphere and of the work-hardening properties of the metal. The second, σ_i (I), is a friction stress probably resulting from the presence of impurity atoms. The grain size parameter, k_y, measures the extra work-hardening which occurs as a result of forced slip during the propagation of yielding through a polycrystal. It is a function of the work-hardening rate of the metal and of the unpinning stress. A criterion for brittle fracture is derived which is based on the observation that, at and above the ductile-brittle transition temperature, a growing microcrack is unable to penetrate the region of forced slip near the boundary of the grain in which it is nucleated. This criterion is used to calculate values of γ_e, the effective surface energy for fracture, for a number of b.c.c. transition metals. The interpretation of these values of γ_e is discussed and it is suggested that for a metal to be brittle it must have both strongly locked dislocations and a high work-hardening rate. A new interpretation of existing experimental results on the hardening and embrittlement of mild steel and molybdenum by neutron irradiation is developed. The deviation from Petch's relation shown by irradiated molybdenum is shown to result from the combination of a particularly high unpinning stress and a high work-hardening rate. (auth)

21069 THE 1962 INSTITUTE OF METALS LECTURE ON SPECIFIC FEATURES OF STRENGTHENED METALS. G. V. Kurdjumov (Metallography and Metal Physics Inst., Academy of Sciences, USSR). Trans. Met. Soc. AIME, 224: 402-15(June 1962).

A review is given on some investigations of the influence of fine structure of metals and alloys upon their resistance to plastic deformation. The fine structure and hardness of quenched steels, role of microstrains in strength of metals, microstrains as indicators of the mechanical properties of crystals in microregions, influence of grain substructure and properties of crystals upon strength, strengthening by neutron irradiation, and strengthening two-phase Fe–C alloys by cold working are discussed. (P.C.H.)

21070 THERMODYNAMICS OF THE URANIUM–CADMIUM SYSTEM. Irving Johnson and Harold M. Feder (Argonne National Lab., Ill.). Trans. Met. Soc. AIME, 224: 468-73 (June 1962).

Thermodynamic functions for dilute solutions of uranium in liquid cadmium were obtained from galvanic cell measurements. Deviations from Henry's law were observed at concentrations down to 2×10^{-3} atom fraction. Unusually large negative values of the partial molal relative enthalpy and excess entropy of uranium, suggestive of the occurrence of partial ordering of cadmium around uranium in these solutions, were found. The negative relative partial molal enthalpy of uranium at the liquidus accounts for the observed retrograde solubility of metallic uranium between 473 and about 630°C. The standard free energy of formation of UCd_{11} from α-uranium and liquid cadmium is given by ΔF_f° (kcal mole^{-1}) $= -27.2 + 36.2 \times 10^{-3}$ T (°K). (auth)

21071 THE INTERACTION OF COPPER AND PALLADIUM WITH THE URANIUM–BISMUTH SYSTEM. Richard E. Balzhiser and David V. Ragone (Univ. of Michigan, Ann Arbor). Trans. Met. Soc. AIME, 224: 485-90 (June 1962).

The liquidus uranium concentration in the U–Bi system is given by the following expression for the temperature range 400 to 800°C: $\log_{10}$ (wt % U) = 3.272 – (2690)/(T (°K)). No break was observed in the curve over this temperature range. The partial molar enthalpy change for uranium in the liquidus reaction, $UBi_2 \rightarrow U + 2Bi$, was found to equal 12300 cal per g mole. Copper produced a continuous decrease in the liquidus uranium concentration at 600°C. The presence of copper in the solvent was observed to affect the uranium activity coefficient according to the following expression: $(d \ln \gamma_U)/(d N_{Cu})_{a_U, T} = +11.0$ for $N_{Cu} < 3$ at.%. Unlike copper, palladium produced no change in the liquidus composition below 0.6 at.% Pd. Higher palladium concentrations sharply depressed the uranium concentration. (auth)

21072 A CONTRIBUTION TO THE CONSTITUTION OF THE TITANIUM–ZIRCONIUM–HYDROGEN SYSTEM. N. Pessall and A. D. McQuillan (Univ. of Birmingham, Eng.). Trans. Met. Soc. AIME, 224: 536-40 (June 1962).

The phase relationships in an isothermal section of the Ti–Zr–H system at 750°C were investigated by measurement of hydrogen equilibrium pressures. The resulting diagram indicates that the hydride phase has an anomalously wide range of homogeneity extending from 66.6 to 30 at.% H in alloys containing about 15 at.% Zr. Measurement of the heat of solution of hydrogen as a function of alloy composition in β-phase alloys indicates no anomalous behavior in the region of 15 at.% Zr, and suggests that the extensive range of homogeneity in the hydride phase at about this composition must be attributed to an enhanced stability of the hydride phase. (auth)

21073 SOLUBILITY AND PRECIPITATION OF BORON NITRIDE IN IRON–BORON ALLOYS. R. W. Fountain (Union Carbide Metals Co., Niagara Falls, N. Y.) and John Chipman. Trans. Met. Soc. AIME, 224: 599-606 (June 1962).

The solubility of nitrogen in Fe–B alloys (0.001 to 0.91% B) was determined by the Sieverts' technique for temperatures of 950 to 1150°C. The activity coefficient of nitrogen is decreased by boron. The three-phase equilibrium between γ iron, BN, and gas is established and also the four-phase equilibrium between γ iron, BN, Fe_2B, and gas. The above equilibria are calculated for α iron. The relation of the data to hardenability and strain aging of boron-treated steels is discussed. (auth)

21074 DISCUSSION: INSTITUTE OF METALS DIVISION. A STUDY OF THE Ti–Cu–Zr SYSTEM AND THE STRUCTURE OF Ti_2Cu. Elmars Ence and Harold Margolin. Trans. Met. Soc. AIME, 224: 611-12 (June 1962).

A Cu–Ti alloy with the composition Ti–33.3 at.% Cu was examined by neutron diffraction. The oxygen content was found by chemical analysis to be 0.06 at.%. Calculated intensities, made on the basis of the same number of atoms scattering, show that all the calculated face centered tetragonal cell lines are very weak because of near null-matrix composition and do not agree with I_{obs}. However, agreement between I_{calc} and I_{obs} for the large cell is believed to be good evidence for the large body centered tetragonal cell. Also, from metallographic evidence, no basis exists for a second phase. (P.C.H.)

21075 DISCUSSION: INSTITUTE OF METALS DIVISION. THE THERMAL DIFFUSION OF HYDROGEN IN ALPHA-DELTA ZIRCALOY-2. J. M. Markowitz. Trans. Met. Soc. AIME, 224: 618-20 (June 1962).

Discussion is given on the main points of a proposed mechanism for the thermal diffusion of hydrogen in alpha-delta Zircaloy-2. Hydrogen in the two-phase region alone is not conserved. One of the important features of the proposed mechanism is that in the presence of a temperature gradient a two-phase region cannot exist over the whole specimen. For example, if the specimen is entirely $\alpha + \delta$ initially, then on application of a temperature gradient, a single phase (α) region at the hot surface develops from time t = 0 onwards. The interface between the α and $\alpha + \delta$ regions moves toward the colder surface of the specimen with a discontinuity in hydrogen concentration developing at the interface and increasing with time. The interface moves at such a rate that hydrogen in the specimen as a whole is conserved. (P.C.H.)

21076 DISCUSSION: INSTITUTE OF METALS DIVISION. THE CREEP BEHAVIOR OF HEAT TREATABLE MAGNESIUM BASE ALLOYS FOR FUEL ELEMENT COMPONENTS. P. Greenfield, C. C. Smith, and A. M. Taylor. Trans. Met. Soc. AIME, 224: 622-4 (June 1962).

A proposal is given for the apparent strengthening at low rates of strain of heat treated Mg/0.5 % Zr alloy (ZA). Instead of the observed strengthening being due to atmosphere locking, it is proposed that precipitates play an important role in enhancing the creep strength of the material. Discussion is given on two possibilities—precipitation of zirconium hydride during the high temperature preanneal and/or precipitation of the hydride or α-zirconium during creep. Previously determined data for both mechanisms are examined. (P.C.H.)

21077 DISCUSSION: IRON AND STEEL DIVISION. EMISSIVITIES OF NIOBIUM (COLUMBIUM) AND NIOBIUM–NITROGEN SOLIDS SOLUTIONS. James R. Cost (Ford Motor Co., Dearborn, Mich.). Trans. Met. Soc. AIME, 224: 634-5 (June 1962).

Results of experiments on the determination of the spectral emissivity, ϵ_λ, for solid niobium as a function of both temperature and nitrogen content are given. In addition, data on the total emissivity, ϵ_T, of niobium and the spectral emissivity of the nitride, Nb_2N, are given. The spectral and total emissivities obtained for pure niobium from 810 to 2132°C are tabulated. The spectral emissivity shows very little variation with temperature. The average ϵ_λ value is 0.345. The total emissivity is found to increase with temperature. The spectral emissivity of Nb at 1960°C with 0 to

8% N in solution shows that nitrogen apparently decreases the spectral emissivity by less than 0.005. However, addition of excess nitrogen resulted in formation of a surface nitride identified as Nb_2N. (P.C.H.)

21078 CONTRIBUTION TO THE TECHNOLOGY OF SINTERED STAINLESS STEELS. Rudolph Reinstadler. Z. Metallk., 53: 86-9(Feb. 1962). (In German)

While the powder-metallurgical production of stainless steel parts, mainly used because of their porosity, occurs at sintering temperatures of 1150°C in protective atmospheres, the production of high-tensile sintered stainless steel demands sintering temperatures of about 1200 to 1300°C. The shrinkage caused by these temperatures makes, in the case of precision parts, the construction of pre-pressing and sizing tools with admeasurement necessary. For the sintering of high-tensile stainless steels, vacuum furnaces in the form of pusher-type furnaces with hydrogen or ammonia cracked gas can be used. (auth)

21079 SOME PROPERTIES OF FUSED AND SINTERED TANTALUM. Ernst Raub and Erich Roeschel (Forschungsinstitut für Edelmetalle und Metallchemie, Gmünd, Ger.). Z. Metallk., 53: 93-103(Feb. 1962). (In German)

Strengthening by cold working, softening, and recrystallization of cold-worked tantalum are studied by measuring hardness, tensile properties, deep drawing, and conductivity and by microscopic investigation. The investigated properties depend very much on the purity of the tantalum, especially on its gas content. Pure electron-beam-melted tantalum with very small gas contents shows only a small cold strengthening. Recrystallization and softening begin at a temperature of 600°C. By the recrystallization very coarse crystal grains are formed. At the same time the high-temperature tensile strength decreases quickly. Tantalum with a higher content of gaseous impurities as it is obtained by tungsten arc-melting softens in two steps. The first step at lower temperatures is caused by recovering from cold strengthening with formation of a smaller grained recrystallization structure. The second step is caused by the gas evolution at higher temperature and formation of a coarse-grained structure. The high-temperature tensile strength then decreases nearly to the value of electron-beam-melted tantalum. (auth)

21080 THE VICKERS HARDNESS OF ENGINEERING MOLYBDENUM AND TUNGSTEN. Hans-Juergen Booss (Fa. Osram Gesellschaft m.B.H., Berlin). Z. Metallk., 53: 104-7(Feb. 1962). (In German)

The Vickers hardness (HV) of molybdenum and tungsten was determined. HV between 5 and 0.1 kg is not affected by the load of the indenter. HV increases with decreasing diameter of the wires and thickness of sheet, respectively. The influence of a thermal treatment and of a plating with nickel, gold, or platinum is examined and discussed. (auth)

21081 X-RAY INVESTIGATIONS OF THE PLASTIC DEFORMATION OF SINTERED NICKEL. Klaus Kolb and Eckard Macherauch (Max-Planck-Institut für Metallforschung, Stuttgart). Z. Metallk., 53: 108-14(Feb. 1962). (In German)

By x-ray measurements of lattice strains the flow stress of surface layers of polycrystalline powdered nickel samples was determined during work hardening. The existence of a macroscopic inhomogeneity of stress distribution over the cross section during the tensile test was found. The mean value of the real stress, acting in the surface crystallites of the polycrystalline specimens, is obviously lower than the average stress of the whole specimen, and consequently the flow stress of the surface grains is lower than that of the grains which are situated in the interior of the sample. This inhomogeneous stress distribution is due to inhomogeneity in work hardening, and it creates a residual macro stress state in the tensile sample after unloading is finished. There are compressive residual stresses in the surface layers which balance tensile residual stresses in the interior of the specimen. In no case was a residual lattice strain distribution according to Greenough's theory observed. The investigations of Kappler and Reimer, which confirm Greenough's theory quantitatively, could not be verified. All calculations of stresses were carried out by using the determined x-ray elastic constants of powdered nickel. (auth)

21082 RECOVERY AND RECRYSTALLIZATION OF NICKEL AFTER COLD DEFORMATION. Friedhelm Bell and Otto Krisement (Max-Planck-Institut für Eisenforschung, Dusseldorf). Z. Metallk., 53: 115-21(Feb. 1962). (In German)

The stored energy in pure nickel after plastic deformation of 27% and 47% compression at −60°C was measured calorimetrically. Two main steps of energy release were found, one about 250°C, the other above 300°C. The first step is attributed to precipitation of vacancies, the second to recrystallization. The isothermal energy-release per unit of time $\dot{Q}_E(t)$ during precipitation of vacancies obeys hyperbolic kinetics: $\dot{Q}_E(t) = \dot{Q}_0\, t^{-n}$; $0.8 \leq n \leq 1.2$. The values $\dot{Q}_0$ and n do not depend on temperature. According to the very small heat effect $\dot{Q}_R(t)$ during recrystallization, the recrystallization kinetics could not be determined accurately. Activation energies for vacancy migration and for grain boundary migration were derived from the measurements. The corresponding values turned out to be $A_W = 1.1$ ev (vacancies) and $A_K = 2$ ev (grain boundaries). The total stored energy Q_E released in recovery of vacancies was measured to be 3 times as much as the total stored energy Q_R in recrystallization. From Q_E and Q_R, vacancy concentrations and dislocation densities could be derived. (auth)

21083 THE GROWTH AND ORIENTATIONS OF NEEDLE-SHAPED TUNGSTEN CRYSTALS. Hans Ahlborn and Guenter Wassermann (Institut für Metallkunde der Bergakademie Clausthal, Ger.). Z. Metallk., 53: 130-8 (Feb. 1962). (In German)

Needle-like tungsten crystals are formed on the surfaces of thin tungsten wires during an annealing treatment by a cyclic oxidation-reduction process in a damp hydrogen atmosphere. The direction of growth in these needle crystals is always one of high crystallographic indices. These indices are the same as those of the wire crystals, formed by secondary recrystallization. In addition the two crystals have one common (1 1 0) direction. It is concluded, that the surface energy of the crystal planes is influenced by "dope substances," included in the wire as impurities. This fact leads to the formation of both the above mentioned types of crystals with the same high crystallographic indices of their longitudinal axes. The process of crystal growth and the influence of the impurities are discussed. (auth)

21084 PROGRESS IN CERAMIC SCIENCE. VOLUME 2. J. E. Burke, ed. New York, Pergamon Press, 1962. 252p. $12.00.

Four papers are included; a separate abstract has been prepared for one. Information is presented on the dislocation etch pits in non-metallic crystals, catalyzed crystallization of glass, thermal conductivity of ceramic dielectrics, and radiation damage in ceramic materials. (N.W.R.)

21085 RADIATION DAMAGE. William Primak and Marion Bohmann (Argonne National Lab., Ill.). p.103-80 of

"Progress in Ceramic Science. Vol. 2." New York, Pergamon Press, 1962.

The effects of radiation on the properties of ceramic materials are studied. Radiation induced phenomena described include collision phenomena, thermal annealing, radiation annealing, transient effects, chemical effects, and atomic excitation. The radiation effects are illustrated by particular ceramic materials. The bibliography contains 855 references. (N.W.R.)

Radiation Effects

21086 (AECL-1484) RADIATION DAMAGE IN ZIRCONIUM, ZIRCALOY-2 AND 410 STAINLESS STEEL. L. M. Howe (Atomic Energy of Canada Ltd., Chalk River, Ont.). Apr. 1962. 41p.

An investigation was conducted to determine the effects of neutron irradiation on the mechanical properties of Zircaloy-2. The test specimens were representative of the fully annealed state, cold worked 13%, and cold worked 25%. It was an additional purpose of the investigation to obtain information on radiation hardening in Zircaloy-2 and Zr, and the embrittling effect of radiation on 410 stainless steel. Radiation hardening was found to anneal out of Zr and Zircaloy-2 at 250 to 400°C at activation energies of about 2.3 ev, and at about 200 to 400°C in the case of 410 stainless steel with an activation energy of 2.4 ev. (J.R.D.)

21087 (AFOSR-2483) STRUCTURAL RESPONSE TO INTENSE ELECTROMAGNETIC RADIATION. First Annual Technical Report, March 1, 1961 to February 28, 1962. Robert C. Good, Jr. (General Electric Co. Missile and Space Vehicle Dept., Philadelphia). Contract AF 49(638)-1030. 66p.

An Exploding Wire Facility was used as the source of electro-magnetic radiation. Power levels of 10^7 watts were deposited in the wire and the radiation pulse was focused on small specimens of selected materials through reflection in an ellipsoidal mirror. For glass samples, the surface crazed to a depth of 10^{-3} cm. Photo-micrographs and profilometer measurements of the surface are presented to support the following conjectures as to the cause of cracking: the energy radiated by the hot wire is absorbed by a thin surface layer of the glass, the associated temperature rise generates thermal stresses, flaws below the glass surface form stress raisers according to the Griffith crack theory, and the cracks subsequently propagate to the surface. The theoretical derivation of the adapted thermoelastic stress theory is used to predict the dimensions of the cracks and the power levels required if the absorption coefficient is at least 10^3 reciprocal centimeters. (auth)

21088 (DOFL-TR-1037) GAMMA INDUCED PHOTOCONDUCTIVITY IN A POLYETHYLENE TEREPHTHALATE CAPACITOR. Edward E. Conrad and Stuart M. Marcus (Diamond Ordnance Fuze Labs., Washington, D. C.). May 4, 1962. 23p.

Results of photoconductivity measurements are presented of Mylar (polyethylene terephthalate) capacitors at gamma radiation fluxes of 10^2 to 4×10^6 r/sec. The results are compared with a semiempirical relation. (J.R.D.)

21089 (DPR/INF/265) THE POST-IRRADIATION EXAMINATION FACILITIES AT THE WINDSCALE WORKS OF THE U. K. ATOMIC ENERGY AUTHORITY. V. W. Eldred and K. Saddington (United Kingdom Atomic Energy Authority. Reactor Group, Windscale, Cumb., England). Feb. 1962. 26p.

The facilities at Windscale for post-irradiation examination are described. The types of fuel elements examined include Windscale fuel elements, Calder fuel elements, and prototypes of fuel elements for new power stations. Diagrams and pictures of the facilities are included. Some of the effects studied are surface roughening of the fuel, bowing, length and diameter changes, swelling, leaks in the can, deformation of heat transfer surface and fittings, microstructure of the fuel, and microstructure of the can. (M.C.G.)

21090 (EURAEC-140) THE EFFECT OF RADIATION ON THE DUCTILE-BRITTLE TRANSITION IN PRESSURE VESSEL STEELS. Quarterly Report No. 2, April–June 1961. E. Anderson, W. Bollmann, D. King, M. Malone, and J. Spreadborough (Battelle Memorial Inst. International Div., Geneva). July 11, 1961. Work performed under United States–Euratom Joint Research and Development Program. 29p.

Activities in a program to examine the mechanism by which neutron irradiation raises the ductile-brittle transition temperature of pressure vessel steels are reported. Progress is reported in specimen preparation, gas analysis, grain size determinations, and electron microscopy. (J.R.D.)

21091 (EURAEC-248) PRELIMINARY STUDY OF AN ISOTHERMAL DIFFUSION EXPERIMENT ON SINTERED URANIUM OXIDE DURING IRRADIATION. Special Report No. 1 [on] SINTERED URANIUM OXIDE, SINTERING TECHNIQUES AND BEHAVIOR UNDER IRRADIATION. (France. Commissariat à l'Énergie Atomique, Paris). Dec. 1961. Work performed under United States–Euratom Joint Research and Development Program. Contract 031-60-10RDI 21p.

Analysis of fission-gas diffusion close to the global process that takes place in an actual fuel unit by attempting to collect the gas diffused from a sample while it is being irradiated is discussed. A loop project for studying the diffusion of fission gases in sintered uranium oxide is described. A simplifying hypothesis is presented likening sintered products to a collection of monocrystalline spheres. The loop developed consists of a closed circuit in which helium circulates at a pressure very near atmospheric. The capsule, gas purification, counting and spectrometry, and quantitative interpretation of spectrums and crystal calibration are described. (M.C.G.)

21092 (GACD-3001) RADIATION EFFECTS ON SILICON SOLAR CELLS. First Quarterly Progress Report Covering the Period December 1, 1961 through February 28, 1962. D. M. J. Compton, S. W. Kurnick, V. A. J. van Lint, and E. G. Wikner (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Mar. 7, 1962. Contract NAS7-91. 8p.

The current research effort status is described including a few electron irradiations of P-doped Si solar cells. The status of various diagnostic tools is also discussed along with plans for future work. (J.R.D.)

21093 (NP-11655) CHARGED PARTICLE RADIATION DAMAGE IN SEMICONDUCTORS. I. EXPERIMENTAL PROTON IRRADIATION OF SOLAR CELLS. Final Report. J. M. Denney and R. G. Downing (Space Technology Labs., Inc., Los Angeles). Sept. 15, 1961. Contract NAS 5-613. 51p. (8987-0001-RU-000).

The effect of proton bombardment on solar cells, particularly Si, was experimentally measured at proton energies of 20.5 to 740 Mev. Comparison of cell type, cell geometry, and parent material, as well as current-voltage characteristics, spectral response, and current decay, with integrated flux at four proton energies is presented. It is

found that a relation of the form $I_{sc} = I_{sc_0}[1 - k(\lambda) \log (\phi/\phi_k)]$ describes the loss of output of all solar cells under proton bombardment in this energy range. The radiation resistance of shallow diffused O-free p on n Si cells exceeds conventional cells by a factor of at least five and exceeds n on p cells by a small percentage. The control of radiation resistance by O and other factors is discussed, and the observation of annealing in n on p cells at room temperature is noted. Curves summarizing radiation damage rates, for power supply design, are presented. (auth)

21094 (NP-11708) THE EFFECTS OF NEUTRON CAPTURE ON REACTOR CONTROL MATERIALS. William E. Ray (Dresser Products, Inc., Great Barrington, Mass.). [1960]. 27p.

A review of properties of reactor control system components is presented. Twenty-four candidate elements are tabulated and it is noted that about 12 of these have been closely examined. Seven elements: B, Cd, Dy, Eu, Hf, In, and Ag were used in reactors. Data and discussion are presented on the more promising candidates. (J.R.D.)

21095 (ORNL-3274) RADIATION STABILITY OF AQUEOUS THORIA AND THORIA-URANIA SLURRIES. J. P. McBride (Oak Ridge National Lab., Tenn.). June 4, 1962. Contract W-7405-eng-26. 22p.

The results of 36 irradiation experiments in the LITR ($2.5-3.0 \times 10^{13}$ n/cm^2·sec) with various thoria and thoria-urania slurries at thoria blanket temperatures indicate that at relatively low irradiation exposures there is no gross deterioration of slurry handling characteristics. Particle damage occurred in most cases, but resistance to damage appeared to increase with increasing oxide firing temperatures. With the exception of Cs, Sr, and I, fission products were mainly associated with the slurry solids. Of the corrosion products (Fe, Cr, Ni), only Ni appeared to a significant extent in the slurry supernatant. During the course of the work a dash-pot-stirred autoclave was developed which permitted fluids and slurries to be stirred while under irradiation. Autoclave operation could be controlled in such a way that the relative viscosity of the autoclave contents could be measured as a function of temperature and while the material was being irradiated. Ability to stir was not impaired by irradiation even at fission power levels equivalent to the average power level of a thoria slurry in a breeder reactor blanket. (auth)

21096 (XDC-60-2-116) GAMMA IRRADIATION OF TURBOJET ACCESSORY SYSTEMS. D. E. Barnett and W. G. Baxter (General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati). Feb. 4, 1960. Contract AT(11-1)-171. 33p.

Results of dynamic tests performed on the X-211 aircraft gas turbine accessory system in a gamma radiation environment are presented. Parts of the fuel, lube, and hydraulic systems were tested at radiation levels ranging from 1.2×10^6 to 2.4×10^7 ergs/gm^{-1}/hr. In general, no serious radiation damage was noted. (J.R.D.)

21097 RADIATION DAMAGE OF SHIELDING GLASS WINDOW. Junichiro Furuta and Shinichi Okamoto. Ann. Rept. Radiation Center Osaka Prefect., 2: 70-7(1961). (In English)

A summary of shielding glass window incidents which occurred over the world is given, and a report is presented on the damaged shielding glass window of the Osaka Radiation Center. On March 10, 1961, the second glass from the hot side of the 8-glass window of Hot Cell 1 (10 kc) was found damaged by many cracks and fractures, although the window was not exposed to radiation for 30 hr prior to the incident. The fractures ran parallel to glass surface and showed a branching pattern (Lichtenberg's figure), and surface discharges were found on both sides. The fractures were independent of striae or bubbles in the glass. New fractures were produced by the light flashes from gamma irradiation. The electrical conductivity of the glass is very low. (D.L.C.)

21098 A STUDY OF THE ATMOSPHERIC CORROSION OF RADIOACTIVE SAMPLES OF "ARMCO" STEEL AND OF CARBON STEEL-2. Vikti I. Spitsyn, K. N. Yandushkin, S. A. Balezin, and I. M. Kuleshov (Inst. of Physical Chemistry, Academy of Sciences, USSR and Moscow State Pedagogical Inst.). Doklady Akad. Nauk S.S.S.R., 143: 1406-8 (Apr. 21, 1962). (In Russian)

Samples of Armco steel and carbon steel 0.8 mm thick with a total surface of 27 cm^2 were subjected to a neutron flux of 0.87×10^{13} neutrons/cm^2-sec in a reactor. The induced radioactivity was 0.22 mc/g or 2.2 mc/sample. The samples were exposed to an atmosphere of 100% relative humidity, and the corrosion was followed by determining the increase in weight of the sample. Unirradiated samples were used as controls. Over a 30 day test period it was found that the rate of corrosion of Armco steel was 178 times that of the control samples, and the rate of corrosion of the carbon steel was 107 times that of the control samples. The rate of corrosion was directly proportional to the specific activity induced in the sample during neutron irradiation. It is believed that lattice defects caused by the radiation accelerate cathodic corrosion. (TTT)

21099 GAMMA-RAY-INDUCED COLORATION IN SOLIDS: APPLICATION TO GLASS SYSTEMS. William H. Cropper (Sandia Corp., Albuquerque, N. Mex.). J. Am. Ceram. Soc., 45: 293-7(June 1962).

General aspects of radiation-induced coloration in solids are discussed. It is considered that the most significant initial effect of the radiation is to produce free electrons and trapped holes in a track. The decay of the track from the initial condition is described in some detail, assuming that the rate of diffusion of electrons from the track is small compared with the rates of other processes and that primary processes which form color centers can be considered to be independent of secondary processes which cause destruction of color centers. A method of calculation is described which gives the concentration of color centers formed at various doses. With plausible assumptions for the parameters, agreement with the data of Schulman et al. on a silver phosphate glass is obtained. The treatment of glasses less simple than the silver phosphate glass is also discussed. (auth)

21100 EFFECTS OF RADIATION DAMAGE ON MECHANICAL PROPERTIES OF MILD STEEL. E. O. Hall (Newcastle University Coll., [New South Wales, Australia]). J. Australian Inst. Metals, 7: 44-9(Feb. 1962).

Some effects of neutron irradiation on the stress-strain curve of mild steel and on the ageing characteristics of the material were determined. The experiments are discussed in relation to theories of ageing and radiation damage. (auth)

21101 INVESTIGATION OF RADIATION DAMAGE IN PURE ALUMINIUM AND ALUMINIUM–1% MAGNESIUM ALLOY BY TRANSMISSION ELECTRON MICROSCOPY. G. R. Piercy and J. L. Whitton (Atomic Energy of Canada, Ltd., Chalk River, Ont.). J. Inst. Metals, 90: 386-8(June 1962).

A fast-neutron irradiation of 4×10^{19} n/cm^2 produced observable dislocation loops only in deformed areas of aluminum, but more uniformly throughout an aluminum–1.0% magnesium alloy that was quenched from 600°C into brine. Because irradiation did not in either case produce observ-

able dislocation loops throughout annealed specimens, the loops produced by irradiation of the deformed or quenched material were probably caused by some of the radioinduced vacancies enlarging the submicroscopic dislocation loops produced by deformation or quenching. If irradiation produces dislocation loops in annealed aluminum or aluminum–1.0% magnesium alloy, these must be much smaller than the minimum observable size of 50 Å dia. (auth)

21102 THE FORMATION OF DISLOCATION LOOPS IN COPPER DURING NEUTRON IRRADIATION. M. J. Makin, A. D. Whapham, and F. H. Minter (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Phil. Mag. (8), 7: 285-99(Feb. 1962). (AERE-R-3770)

The thin film transmission electron microscope technique was used to make a quantitative study of neutron damage in copper. The density of observable defect clusters was measured as a function of diameter after various neutron doses between 0.61×10^{18} and 3.79×10^{18} fast n cm^{-2}. The total number of clusters and point defects in the visible damage is approximately linear with dose and indicates that ~50 point defect pairs are formed per primary knock-on atom. The data were compared with the calculated results of various models of nucleation and growth and the results show that the homogeneous theory of nucleation by the chance collision of isolated point defects does not fit the experimental evidence. A simple heterogeneous theory in which the nuclei for the loops are formed directly by the irradiation can be fitted to the results, however, and it is suggested that nuclei are formed in the displacement spikes by the primary knock-on atoms. The concept of a critical nucleus size is introduced to account for the experimental observations on the formation of loops in various metals bombarded with different particles. (auth)

21103 AGGLOMERATION INTO CLUSTERS OF INTERSTITIAL ATOMS AND VACANCIES GENERATED BY FAST NEUTRON IRRADIATION. J. H. O. Varley (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Phil. Mag. (8), 7: 301-13(Feb. 1962).

A model is presented to describe the experimentally observed aggregation of vacancies and interstitials, generated by fast neutron irradiation, into clusters. The parameters occurring in the model are chosen empirically to fit the experimental facts and some theoretical justification for the values so obtained is given. (auth)

21104 THE FORMATION OF DISLOCATION LOOPS IN COPPER DURING NEUTRON IRRADIATION. R. V. Hesketh (Berkeley Nuclear Labs., Berkeley, [Gloucester, Eng.]). Phil. Mag. (8), 7: 519-21(Mar. 1962).

In order to have better agreement between experiment and analysis of loop size distribution in neutron-irradiated copper crystals, better data were obtained by considering the dependence of defect-dislocation loop elastic interaction energy on loop radius. Several equations for the interaction energy between a defect and an edge dislocation are reviewed and discussed. Illustrative results show that the heterogeneous nucleation theory is in agreement with long-range defect-dislocation loop elastic interaction; that it is possible that all the loops observed are of one species, and that the diameter of the nuclei on which the loops form is probably 6 Å and certainly less than 10 Å. (N.W.R.)

21105 THE EFFECTS OF ELECTRON IRRADIATION ON CRYSTALS OF POTASSIUM CHLORIDE. M. R. Tubbs and A. J. Forty (Univ. of Bristol, Eng.). Phil. Mag. (8), 7: 709-14(Apr. 1962).

The results of an investigation on KCl show that while the electron beam undoubtedly has a marked effect on the crystals, it is possible to examine KCl in the electron microscope, and in this way, to study the changes which follow irradiation in considerable detail. Preliminary investigations suggest that point defects are created fairly readily in KCl crystals by electron irradiation. The fact that small crystals are strongly colored in the F-band by irradiation in the microscope is taken as evidence that some ionization takes place. (P.C.H.)

21106 THE DETECTION OF DISPLACEMENT SPIKES BY MEASURING THE EFFECT OF PARTICLE SIZE ON THE DISSOLUTION OF PRECIPITATE PARTICLES BY FAST-NEUTRON IRRADIATION. G. R. Piercy (Atomic Energy of Canada Ltd., Chalk River, Ont.). Phys. and Chem. Solids, 23: 463-77(May 1962). (In English)

Samples of Cu–2 wt. % Co, aged to form precipitate particles between 12.4 and 50 Å radius, were irradiated with 3.4×10^{19} fission neutrons/cm^2 at 50°C. The precipitate particle size was measured using the superparamagnetic effect. Only samples with particles smaller than 12.4 Å radius showed any dissolution of precipitate particles. The results were consistent with the model that every fission-neutron collision produced a displacement spike having an average volume of radius 34 Å and a diffusion distance greater than $\sqrt{Dt} = 8$ Å. (auth)

21107 EFFECT OF RADIATION ON THE ELECTRIC CONDUCTIVITY OF SEMICONDUCTOR FILMS. O. K. Botvinkin and O. V. Vorob'eva. Steklo i Keram., 19: No. 1, 4(Jan. 1962).

Experiments conducted with tin dioxide films 0.5–0.7 μ thick, activated by antimony and applied on BBC glass 4 mm thick, showed that γ irradiation with a dose of $5.6 \cdot 10^5$ r does not modify the conductivity of the films. This is explained by the crystalline structure of the films, which prevents formation of additional active centers. Other experiments showed that parts of apparatus and devices subjected to γ radiation can be coated with tin dioxide films without undergoing any changes in their electrical parameters. (OTS)

21108 EFFECT OF IONIZING RADIATION ON METAL OXIDE FILMS APPLIED TO GLASS. S. M. Berkhovskikh and I. I. Borisova. Steklo i Keram., 19: No. 1, 4-6(Jan. 1962).

The radiation optical stability of metal oxide films on glass was studied using films formed by the pyrolysis of Cd, Co, and Ni acetates, Pb and Ag nitrates, and Al, V, Bi, Te, Mn, Cu, Sr, Ti, Cr, Zn, and Zr chlorides. The films were applied to heat-resistant glass with high radiation-optical stability and irradiated by a Co^{60} source. Doses of 10^3, 10^5, and $6.8 \cdot 10^7$ r were applied. It was found that doses of 10^3 and 10^5 r do not affect the light transmission of films, except for those obtained by the pyrolysis of $AgNO_3$. This property of $AgNO_3$ coatings indicates that they might find application in γ-quanta dosimetry. Doses of $6.8 \cdot 10^7$ r generally darkened the films and reduced the light transmission of the specimens; $AgNO_3$ films became mirrorlike and their light transmission dropped to 8.7%. Study of the spectral light transmission of $AgNO_3$ before and after irradiation with doses of 10^3 and 10^5 r showed that: irradiation reduces the spectral light transmission in the wavelength range from 350 to 1100 Mμ; and up to 380 Mμ, light transmission is lower for specimens irradiated with 10^5 r, but from 390 to 1100 Mμ it is lower for specimens receiving a dose of 10^3 r. It was further shown that the resistivity of the metal oxide coatings is not affected by irradiation with doses from 10^3 to $6.8 \cdot 10^7$ r. It was assumed that irradiation does not cause either a direct ionization or a distortion of the regularity of the crystal lattice. The desirability of further studies with doses of 10^9 and 10^{10} r and with gamma neutron irradiation is stressed. (OTS)

PHYSICS

General and Miscellaneous

Refer also to abstract 20619.

21109 (AD-237966) RESEARCH AND DEVELOPMENT OF THERMOCOUPLE ENERGY CONVERTERS. Quarterly Progress Report No. 1, December 3, 1959–February 29, 1960. (General Electric Co. Electronics Lab., Syracuse, N. Y.). Contract DA-30-069-501-ORD-2855. 33p.

It is the objective of this research program to develop encapsulated thermoelectric (TE) components for use in a TE generator and yielding a specific electrical power output w of 0.46 w/cm^3 or more. A theoretical analysis of w was made and the following conclusions were reached: (a) w does not depend on the thermal conductivity, (b) its magnitude is primarily governed by S^2/ρ and (grad T)^2, and (c) standard encapsulated TE materials such as lead telluride appear to be adequate for meeting the requirements. A new type of capsule was designed and constructed that has a potential temperature capability in excess of 1050°C while minimizing the effects of differential thermal expansion on its mechanical stability, maximizing the temperature gradient across the TE material, and permitting a separation of the sealing and filling operations. (auth)

21110 (AD-251485) RESEARCH AND DEVELOPMENT OF THERMOCOUPLE ENERGY CONVERTERS. Summary Report, December 3, 1959 to August 31, 1960. (General Electric Co. Electronics Lab., Syracuse, N. Y.). Contract DA-30-069-501-ORD-2855. 38p.

A theoretical analysis of the specific electrical power output was made. It was concluded that power output does not depend on the thermal conductivity, that its magnitude is primarily governed by S^2/ρ and (grad T)^2, and that the standard encapsulated TE materials, such as PbTe, appear to be adequate for meeting the requirements. A design is presented for encapsulating the TE material, which minimizes thermal stresses and extraneous heat losses. The temperature gradient across the TE material is maximized and the sealing and filling operations are separate and independent. The encapsulating material has a potential operational capability in excess of 1050°C, and the capsule appears to be excellent and suitable for quantity fabrication. Several methods for filling capsules with TE grade PbTe were investigated. Oven-type filling techniques were used successfully, however, this technique could not be simplified sufficiently for quantity production. (auth)

21111 (AD-265106) RESEARCH PROGRAM ON SEMICONDUCTING COMPOUNDS FOR THERMOELECTRIC POWER GENERATION AT HIGH TEMPERATURES. Progress Report No. 3, September 15, 1960 through November 14, 1960. C. R. Lewis (Chrysler Corp. Engineering Div., Detroit). Contract NObs-78664. 17p.

Samples of WSe_2 and WTe_2 were prepared. The material resulting from mixing Ta powder and Se in a 1:4 atomic ratio gave a complex x-ray-diffraction pattern indicating a TaSe phase of low crystal symmetry. A compound was prepared which is probably a Laves-type phase of nominal composition $Ta_{11}Te_8$. Difficulties were encountered in producing a Ta–Ge compound in sufficient quantity for measurement because of the large increase in volume during the reaction. An unknown phase was indicated in the reaction material from a 1:4-atom-ratio mixture of Hf and Se. A dark powder obtained from an Re–Se sample reacted at 1200°F for 260 hr may have useful properties as a solid lubricant. Results are presented of Seebeck coefficient and resistivity measurements made on NiAl, TaSb, WTe_2, and WSe_2. (auth)

21112 (AD-266009) HIGH TEMPERATURE SEMICONDUCTING COMPOUNDS FOR THERMOELECTRIC POWER GENERATION. Bi-Monthly Progress Report No. 2, February 15, 1961 to April 15, 1961. C. B. Jordan (Electro-Optical Systems, Inc., Pasadena, Calif.). Apr. 30, 1961. Contract NObs-84327. 7p. (EOS-1592-2M-2)

Several runs were made in the high-pressure furnace with the object of synthesizing sulfides of U and of Th. The first run was made using only a small amount of the reactants (U turnings and S) and raising the temperature very slowly to 780°C. After cooling, the reaction product appeared to be an inhomogeneous mixture of sulfides varying in color from brown to dark gray. An attempt to identify the specimen by x-ray diffraction failed. In a second run, U and S were heated to about 2000°C. X-ray diffraction gave a weak pattern of US, but the presence of other phases cannot thereby be ruled out. The result of a third run, in which U and S were again heated to 2000°C, was an ingot which appeared to have completely melted, and which had a bright metallic luster. An attempt to identify the substance by x-ray diffraction, resulted in a film on which no reflections appeared, and only a light background. Subsequently, a pattern was obtained; however, all attempts to identify the pattern failed. (auth)

21113 (AD-266197) ELECTRON DENSITY MEASUREMENTS WITH A POUND SYSTEM IN FLOWING IONIZED HELIUM. Report No. 5-50. A. P. Deam (Texas. Univ., Austin. Electrical Engineering Research Lab.). Sept. 30, 1961. Contract AF33(616)-6257. 26p.

The use of a Pound stabilized oscillator to measure electron densities is discussed. Although it is primarily concerned with the application of the Pound system, data are presented as evidence of measurements conducted. These data are in the form of electron decay curves obtained in a flowing gas system, where the gas used was commercial grade He with an estimated content of Ne amounting to 1 part in 10^{-4}. (auth)

21114 (AD-267458) SPUTTERING YIELDS. Annual Report, November 1, 1960 to October 31, 1961. Report No. 2243. G. K. Wehner, R. V. Stuart, and D. Rosenberg (General Mills, Inc., Minneapolis). Nov. 15, 1961. Contract Nonr-1589(15). 97p.

Sputtering yields of meats under noble gas ion bombardment was investigated. Three papers and 2 reprints are given. Separate abstracts were prepared for 2 papers. One paper was previously abstracted for NSA. (M.C.G.)

21115 (AD-267458(Pt. I)) PHYSICAL SPUTTERING. G. K. Wehner (General Mills, Inc., Minneapolis). Part I of SPUTTERING YIELDS. p. 1-24.

Research on physical sputtering and sputtering yields is reviewed. Examples are discussed. Problems which remain in the field of sputtering are surveyed. (M.C.G.)

21116 (AD-267458(Pt. V)) SPUTTERING YIELDS AT VERY LOW BOMBARDING ION ENERGIES. R. V. Stuart and G. K. Wehner (General Mills, Inc., Minneapolis). Part V of SPUTTERING YIELDS. p.53-84.

The spectroscopic method was used to study sputtering

yields under normally incident ion bombardment at very low ion energies. Data were extrapolated to determine threshold energies for sputtering under normal incidence. These estimated thresholds were approximately the same energy (roughly four times the heat of sublimation) as the displacement thresholds for radiation damage. The mass ratio between ion and target atom played hardly any role in the thresholds. (auth)

21117 (AD-269326) ON ONE DIMENSIONAL HYDROMAGNETIC FLOW WITH TRANSVERSE MAGNETIC FIELD. PART 1. SIMPLE WAVE FLOW. PART 2. FLOW IN A CHANNEL WITH SMALL AREA VARIATIONS. MRC Technical Summary Report No. 269. Roy M. Gundersen (Wisconsin. Univ., Madison. Mathematics Research Center). Oct. 1961. Contract DA-11-022-ORD-2059. 8p.

The one-dimensional non-steady motion of an ideal, inviscid, perfectly conducting fluid subjected to a transverse magnetic field is studied. The particle velocity, local speed of sound, specific entropy, density, square of Alfven speed, permeability, and ratio of specific heat at constant pressure and at constant volume are considered. Partial derivatives are denoted by subscripts, and all dependent variables are functions of x and t. (auth)

21118 (AEEW-M-220) FEASIBILITY STUDY FOR COMPLEX FREQUENCY TESTING. C. B. Guppy (United Kingdom Atomic Energy Authority. Reactor Group. Atomic Energy Establishment, Winfrith, Dorset, England). Oct. 1961. 8p.

A discussion of the theory associated with the concept of complex frequency testing is presented. An evaluation of its characteristics is included. (J.R.D.)

21119 (AFBSD-TR-61-80) THE HALL AND ION SLIP EFFECTS IN A NON-UNIFORM GAS. Research Report 121. R. J. Rosa (Avco Corp. Avco-Everett Research Lab., Everett, Mass.). Dec. 1961. Contract AF04(694)-33. 33p.

Under conditions that result in strong Hall or ion slip effects, a uniform and a nonuniform gas can behave much differently as conductors of electricity. An ohms law for a nonuniform gas is derived. It is used to study the performance of normal current and Hall current MHD devices and the possibility for obtaining significant electron heating or "extra thermal" ionization. An indication is obtained of the degree of engineering development required to obtain good performance at high $\omega\tau$. (auth)

21120 (AFCRL-62-294) WHISTLER DISPERSIONS FOR A MODEL OF THE IONIC DISTRIBUTIONS IN THE EXOSPHERE. T. N. L. Patterson (Queen's Univ., Belfast). [1962]. Contract AF61(052)-131. 17p.

Calculations are presented concerning the dispersions of whistling atmospherics for an exosphere ion distribution model. Temperatures of 1000, 1250, 1500, and 2000°K are considered at 30, 35, 40, and 45° latitudes. (J.R.D.)

21121 (AFCRL-1062-I) RESEARCH ON PHYSICS OF THE UPPER ATMOSPHERE. Technical (Final) Report. Part I. D. R. Bates, A. Dalgarno, A. H. Jarrett, B. L. Moiseiwitsch, R. McCarroll, and A. L. Stewart (Queen's Univ., Belfast). June 30, 1961. Contract AF61(052)-131. 178p.

A theoretical basis for calculation of the polarizabilities of atomic oxygen and atomic nitrogen was formulated, and numerical calculation was carried out. Differential scattering cross sections for inelastic electron impact with hydrogen and helium were calculated using the first and second Born approximations. Ion-atom and atom-atom collisions involving excitation were given quantitative treatment by a new approximation. A scanning interferometer was developed for study of the profiles of the 01 green and red lines in the aurora, twilight, and nightglow. An infrared spectrograph was developed. Inner shell ionization was studied. (M.C.G.)

21122 (AFCRL-1062-II) RESEARCH ON PHYSICS OF THE UPPER ATMOSPHERE. Technical (Final) Report. Part II. (Queen's Univ., Belfast). 1961. Contract AF61(052)-131. 224p.

Research and development progress is reported on scattering of heavy particles by diatomic molecules, the accurate calculation of bound state atomic properties, calculations of electron capture cross sections using a new approximation, investigations of resonance electron capture in slow collisions, an all-sky camera interferometer, general theoretical investigations of upper atmospheric processes, theoretical studies of the broadening of Ly α by electron collisions, and auroral studies. (M.C.G.)

21123 (AFOSR-1959) MAGNETIC RESONANCE STUDIES OF LITHIUM VANADIUM BRONZE. Julien Gendell, R. M. Cotts, and M. J. Sienko (Cornell Univ., Ithaca, N. Y.). Jan. 16, 1962. Contract AF49(638)-191. 34p.

The nuclear magnetic resonance of Li^7 in $Li_xV_2O_5$ shows no Knight shift, but there is a small diamagnetic shift relative to LiCl solution, amounting to 0.0023 and 0.0058% at 296 and 77°K, respectively. The spin-lattice relaxation time, T_1, as measured by pulse experiments, decreases from 0.16 sec at 296°K to a minimum of 0.060 sec at 165°K and then rises to 0.13 sec at 77°K. The free induction decay half-width decreases from 850 μsec at 296°K to 100 μsec at 77°K. The minimum in T_1 is attributed to back-and-forth motion of the Li ions within but normal to the axis of channels in the O framework; the line narrowing, to diffusion along the channel from one unit cell to an adjacent one. EPR studies give Lorentzian-shaped lines, centered at $g = 1.96$, of intensity proportional to 1/T. Results are consistent with a model in which Li atoms in a host V_2O_5 structure are completely ionized to give Li^+ ions and electrons which are almost but not completely localized as V^{4+} centers. (auth)

21124 (AFOSR-2674) SOME CONSIDERATIONS ON RADIATION MAGNETOGASDYNAMICS. S. I. Pai (Maryland. Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics). Apr. 1962. Contract AF49(638)-401. 31p. (BN-286)

A preliminary macroscopic analysis is presented of a high-temperature flow of gas including aspects of the gasdynamic, electromagnetic, and radiation fields considered simultaneously. Fundamental gas dynamics equations are examined in relation to basic heat transfer modes such as conduction, convection, and radiation. (J.R.D.)

21125 (ANL-6517) PHYSICS DIVISION SUMMARY REPORT, FEBRUARY–MARCH 1962. (Argonne National Lab., Ill.). Contract W-31-109-eng-38. 84p.

Progress is reported in experimental nuclear physics and calculations concerning the distribution of lifetimes of neutrons in glass scintillation neutron detectors and on the probabilities for single, double, and triple scattering of neutrons in thin plates. Precision measurements of gamma-ray energies and intensities were used to modify and extend the level scheme of Hf^{178}. The presence of three K = 0 rotational bands (besides the ground state) and two K = 2 rotational bands are indicated in the level scheme of this isotope. In other work the fluorescence properties of polystyrene were found to depend on concentration of residual styrene monomer and the average molecular weight. Research is also reported in theoretical physics on dynamics of nuclear collective motion, scatter-

ing of alpha particles by a vibrational nucleus, flux quantization and time-reversal degeneracy, and elastic nucleon-nucleon scattering at high energies and small angles. (J.R.D.)

21126 (D1-82-0164) THE TEMPERATURE DEPENDENCE OF THE EXTENDED X-RAY ABSORPTION FINE STRUCTURE. Farrel W. Lytle (Boeing Scientific Research Labs., Seattle). Apr. 1962. 21p.

An investigation was conducted to test the validity of the Kronig theory. Resulting data on the x-ray-absorption fine structure temperature were found to support the Kronig diffraction mechanism demonstrating a diffraction mechanism for the extended x-ray-absorption fine structure. (J.R.D.)

21127 (MND-P-2483-5) SNAP 7 PROGRAM—TASK 8—STRONTIUM-90 FUELED THERMOELECTRIC GENERATOR DEVELOPMENT. Quarterly Progress Report No. 5, November 1, 1961 to January 31, 1962. W. A. McDonald (Martin Co. Nuclear Div., Baltimore). Contract AT(30-3)-217. 41p.

The SNAP 7A battery and converter were subjected to the required shock, vibration and temperature tests. The generator was fueled, postfueling radiation levels were checked and the generator was integrated into the complete SNAP 7A system. After the completion of acceptance tests, the SNAP 7A system was installed in a buoy which, in turn, was anchored in the bay where it will be subjected to further evaluation. The SNAP 7C generator was shipped for transport to Antarctica. The generator will power a five-watt U. S. Navy remote weather station. Tests were also conducted to determine the operational characteristics of SNAP 7B and 7D thermoelectric couples. Also, the reliability model of the generator was operated at high temperature for 23 days. The electrical, converter and battery specifications for the SNAP 7D system were completed and released. The primary effort in the fuel processing phase of the program was to provide the necessary liaison with the personnel installing the processing equipment. Maintenance and checkout guides were written to assure satisfactory installation and continued performance throughout the fuel processing span. An operation procedure guide was written to describe the engineering concept of the fuel processing operation. The guide was written for the personnel who will be conducting the fuel processing operation. (auth)

21128 (MRL-118) A THEORETICAL INVESTIGATION OF SOME MAGNETIC AND SPECTROSCOPIC PROPERTIES OF RARE-EARTH IONS. A. J. Freeman and R. E. Watson (Watertown Arsenal. Materials Research Lab., Mass.). May 1962. 57p.

Investigations of some magnetic and spectroscopic properties of rare-earths ions based on approximate Hartree-Fock calculations are reported. A set of conventional, nonrelativistic Hartree-Fock wave functions were obtained for Ce^{3+}, Pr^{3+}, Nd^{3+}, Sm^{3+}, Eu^{2+}, Gd^{3+}, Dy^{3+}, Er^{3+}, and Yb^{3+}. After these calculations for Ce^{3+} were carried out in which spin-orbit coupling was directly included in the conventional Hartree-Fock equations in order to obtain some estimate of wave function dependence on J and the resulting effects on experimental quantities. (auth)

21129 (NP-11640) RESEARCH INVESTIGATION DIRECTED TOWARD EXTENDING THE USEFUL RANGE OF THE ELECTROMAGNETIC SPECTRUM. Quarterly Progress Report No. 9, December 16, 1961 through March 15, 1962. R. Novick (Columbia Univ., New York. Columbia Radiation Lab.). Mar. 15, 1962. Contract DA-36-039-SC-78330. 66p. (CU-3-62-SC-78330-Phys.)

Several modifications of the 30 foot beam apparatus which will be used to measure the lifetime of the metastable state of helium ions are described. Level crossing experiments utilizing optical methods (double resonance methods) were employed to measure the hyperfine Zeeman structure of isotopes of zinc, sodium, rubidium, and cadmium. Complete results are given for the radiative lifetime of the $^3P_1$ state of cadmium. A new experiment for measuring the electronic fine structure of ionized lithium is under way. Similar experiments are proposed for various states of calcium and strontium. Several radioactive species are also being studied by the double resonance technique, principally cadmium and calcium. Progress is described on several molecular physics projects, including molecular beams experiments employing velocity selection and electric resonance, and microwave and maser spectroscopy. Several advances in the optical maser program are described. A number of radioastronomical measurements, made possible by the existence of a maser-telescope are proposed. A superconducting magnet, for the production of extremely high fields, is under construction. (auth)

21130 (NP-11643) NRL QUARTERLY ON NUCLEAR SCIENCE AND TECHNOLOGY. Progress Report for the Period January–March 1962. (Naval Research Lab., Washington, D. C.). Apr. 1, 1962. 66p.

In nuclear physics research, activities are reported in programs on electric charge and the group-space proper Lorentz group, design of proposed NRL LINAC beam handling and shielding system, transport equation approximate solution, cyclic character of odd-even nuclei, use of solid state detectors, and the effect of bromide ion on evaluation of H from irradiated alkane solutions. In beam and plasma physics research, progress is reported on analysis of a sheet beam, effects of electric fields in stabilization of transverse beam oscillations near a partially conducting wall, and parameter effects on the pulse shape of a line-type modulator. (J.R.D.)

21131 (NP-11647) RESEARCH AND DEVELOPMENT THERMOCOUPLE ENERGY CONVERTERS. Summary Report Covering the Period December 3, 1959 to August 31, 1960. (General Electric Co. Electronics Lab., Syracuse, N. Y.). Contract DA-30-069-501-ORD-2855. 43p.

A theoretical analysis of the specific electrical power output was made, and the following conclusions were reached: (1) it does not depend on the thermal conductivity, (2) its magnitude is primarily governed by S^2/ρ and (grad $T)^2$, and (3) standard encapsulated TE materials, such as lead telluride, appear to be adequate for meeting the requirements. A novel design was conceived and implemented for encapsulating the TE material. This design minimizes thermal stresses and extraneous heat losses. It maximizes the temperature gradient across the TE material and makes the sealing and filling operations separate and independent. It has a potential operational capability in excess of 1050°C. Subject to the completion of external attachments, the quality of this capsule appears to be excellent and suitable for quantity fabrication. Several methods for filling capsules with TE grade lead-telluride were investigated. Despite difficulties, a neutral atmosphere oven-type filling technique was developed and used successfully. Unfortunately, this technique could not be simplified sufficiently for quantity production. (auth)

21132 (NP-11652) DUST FORMATION AND RADIATION DAMAGE ON THE LUNAR SURFACE. Paul Grannis (Cornell Univ., Ithaca, N. Y. Center for Radiophysics and Space Research). Sept. 18, 1961. Contract NASA NsG 119-61. 14p.

The time required to darken an exposed lunar surface with x rays from solar flares is calculated to be between 10^3 to 5 years. The effects of kilovolt proton bombardment on the crystalline structure of SiO_2 are discussed, and it is concluded that such bombardment is not likely to produce disintegration, either by internal strains and disordering or by chemical action of the thermalized hydrogen ions. Sputtering by H^+ ions may produce a dust layer of $\sim 3 \times 10^{-7}$ cm/year. The effect of two charge layers formed by kilovolt protons in SiO_2 is probably negligible. The average thickness of the lunar surface converted to dust yearly by micrometeorites is calculated to have an upper limit of 1.1 microns. (D.L.C.)

21133 (TID-3911) THERMOLUMINESCENCE—BIBLIOGRAPHY. Ernest E. Angino (Kansas. Univ., Lawrence) and N. Grogler (Bern. Universität. Physikalisches Institut). Mar. 22, 1962. Contract [AT(11-1)-1057]. 28p.

A bibliography is presented on thermoluminescence. References are included on applications of thermoluminescence as a research tool in the fields of phosphor chemistry, geochemistry, geochronology, geology, ceramics, physics, and chemistry. (C.H.)

21134 (TID-15639) THE DETERMINATION OF K SHELL CONVERSION COEFFICIENTS USING A NaI SINGLE CRYSTAL SCINTILLATION SPECTROMETER (thesis). Russell L. Heath (Vanderbilt Univ., Nashville). Mar. 1957. 65p.

Techniques of gamma scintillation spectrometry and their application to the measurement of internal conversion coefficients were investigated. Results of studies of the response of NaI(Tl) to monoenergetic gamma radiation over a wide energy range are presented along with a description of the techniques of absolute gamma intensity determination. Determinations of the K shell internal conversion coefficients for Cs^{137}, Hg^{203}, and Ce^{141} were made by comparison of the number of characteristic x rays with the number of gamma rays emitted in each case. (M.C.G.)

21135 (TID-15706) SPATIAL DISTRIBUTION OF ENERGY DISSIPATION BY A BREMSSTRAHLUNG SPECTRUM (thesis). David Tobias Goldman (Vanderbilt Univ., Nashville). June 1954. 37p.

The radiological importance of the fact that the spatial distribution of ionization produced by medium energy gamma rays is not attenuated in the same manner as the gamma rays themselves is discussed. For a pilot calculation, water was selected as the diffusion medium, and the source of ionization was bremsstrahlung produced by a 40-Mev betatron beam. The validity of simplifications used is shown. Gamma and electron diffusions were calculated in terms of Legendre and Laguerre coefficients. These coefficients were also used in reconstructing the distribution which was represented as the product of a weight function and a sum of polynomials orthonormal with respect to the weight function. (M.C.G.)

21136 (TID-15708) MEASUREMENTS OF IONIZATION PRODUCED BY 5 Mev ALPHA PARTICLES IN ARGON MIXTURES (thesis). Charles Estel Melton (Oak Ridge National Lab., Tenn.). Feb. 1954. 58p.

Submitted to Vanderbilt Univ., Nashville.

A systematic study was made of argon by adding other gases to it in measured quantities and observing their effect on W, the average energy required to produce an ion pair by alpha reactions. The gases for the argon mixtures were selected to meet the requirement of a continuous range of ionization potentials from 8.5 to 15.7 ev in order to study their effect on the number of ion pairs per alpha particle both above and below the metastable state. Alpha particles from Pu^{239} with an average energy of 5.14 Mev were used for the measurements. Data are presented in graphs and tables. Sixteen of the gases when combined with argon produced a mixture which had a W value less than that of either of the pure gases. The possibility that this increase in ionization is due to excited levels is discussed. (M.C.G.)

21137 (UCRL-6779) SCATTERING OF ACOUSTIC AND ELASTIC WAVES BY SURFACES OF ARBITRARY SHAPE (thesis). Robert P. Banaugh (California. Univ., Livermore. Lawrence Radiation Lab.). Feb. 15, 1962. Contract W-7405-Eng-48. 185p.

The problem of the scattering of acoustic and elastic waves from arbitrarily shaped objects is stated in terms of simultaneous singular integral equations. In contrast to many existing approaches, the formulation employed is exact since the boundary conditions are all entered without the necessity of approximation and the object may have any arbitrary shape including corners and edges. Solution of the integral equations provides the surface potentials from which the field potentials are then obtained by surface integrals. The formulation is given for both the two- and three-dimensional problem and for the three cases of interest; the object is a rigid body, the object is a void, and the object is another elastic medium. The extension of the method to time-dependent problems is also indicated. The equations are solved using finite difference approximations to the contour integrals. The numerical results are in excellent agreement with those obtained from a series solution of the scattering of a plane wave from a rigid circular cylinder. Further numerical results are given for the scattering of two-dimensional acoustic waves from rigid and soft obstacles of arbitrary shape. Similar results are presented for elastic wave scattering from some arbitrarily shaped rigid cylinders. (auth)

21138 (UCRL-6809) EMISSION CHARACTERISTICS OF TANTALUM, TUNGSTEN, RHENIUM, AND IRIDIUM IN PLASMA DIODES. Willian H. Gust (California. Univ., Livermore. Lawrence Radiation Lab.). Mar. 15, 1962. Contract W-7405-eng-48. 25p.

Experimental determinations of the ionic and electronic emission characteristics of Ta, W, Re, and Ir cathodes in vapor thermionic converters are compared. It is shown that Ta provides superior thermal ionization qualities at high pressure compared with W, Re, and Ir. High electronic current densities may be obtained from Cs on Re and Cs on Ir at much lower Cs vapor pressures than from Ta or W. An over-all efficiency of 19% was achieved with a Re cathode at 2440°K. (auth)

21139 (UNM-TR-EE-73) HYPERSONIC PLASMA GENERATOR. Andre LeBlanc and W. W. Grannemann (New Mexico. Univ., Albuquerque. Engineering Experiment Station). Apr. 1962. For Sandia Corp., Albuquerque, N. Mex. Contract [AT(29-1)-789]. 32p.

A literature survey was conducted on thermionic plasma diodes for background in analysis of the hypersonic plasma diode. Other work is also reported on plasma resistivity and thermoelectric equations for plasma. Generator modes of operation are analyzed and potential diagrams are discussed. (J.R.D.)

21140 (AEC-tr-5048) AN APPARATUS FOR THE DIRECT TRANSFORMATION OF THERMAL ENERGY TO ELECTRICAL ENERGY. W. Bloss. Translated by George M. Grover and Gretchen R. Riese (Los Alamos Scientific Lab., N. Mex.) from Naturwissenschaften, 48: 497-8(1961). 6p.

The device has an indirectly heated BaO incandescent cathode which acts as the principal one. The anode consists of a semiconducting layer. The positive ions of an auxiliary discharge between the principal cathode and a small auxiliary incandescent cathode through Ar or Kr at a gas pressure of 0.2 to 0.6 Torr and compensate for the electron space discharge in front of the principal cathode. Under these conditions the output current is dependent on the current and voltage of this auxiliary discharge. (J.R.D.)

21141 (AEC-tr-5063) PRESSURE GRADIENT OCCURRING DURING GASEOUS DIFFUSION. L. Waldmann and K. H. Schmitt. Translated for Oak Ridge National Lab., Tenn. Z. Naturforsch., 16a: 1343-54(1961). 33p.

Closely related to the pressure effect in flows through capillaries is the motion of suspended particles in diffusing gas mixtures. Observations indicated that the direction of motion of the suspended particles at low pressure is opposite to their motion at high pressures in some cases. This change was confirmed by capillary diffusion experiments with N_2/C_2H_4 and with Ar/CO_2 mixtures. (J.R.D.)

21142 (CEA-tr-A-1087) LE PROBLEME DE L'EMISSION DES EXO-ELECTRONS. (The Problem of the Emission of Outer Electrons). R. Seidl. Translated into French from Czechoslov. J. Phys., 10: 931-47(1960). 37p.

The emission of exo-electrons by the alkaline halides NaCl and KCl was studied on artificial single crystals whose purity was known. The crystals were excited by x radiation at temperatures from 20 to 500°C. The experimental results show that the pattern of the emission of exo-electrons is determined by the properties of the surface layer of the emitter. These properties can differ greatly from the volume characteristics. There are cases where no measureable emission is produced in correlation with depth discoloration. A moderating effect can be attributed to the pollution of the surface layer by gases in contact with the emitter. No sign of a mechanism different from that of other substances was found. These results were analyzed in order to obtain a clearer understanding of the mechanisms involved. (J.S.R.)

21143 (NP-tr-886) INVESTIGATIONS OF BALMER SPECTRA IN THE PRESENCE OF A HIGH-FREQUENCY DISCHARGE. H. Schlueter. Translated by E. S. Fountain (U.K.A.E.A. Atomic Energy Research Establishment, Harwell, Berks, Eng.) from Z. Naturforsch., 16: 972-84 (1961). 32p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 16, abstract no. 10749.

21144 LOCALIZATION OF ENERGY AND QUANTIZATION OF THE GRAVITATIONAL FIELD. Jerzy Rayski (Jagiellonian Univ., Krakow). Acta Phys. Polon., 21: 99-109(1962). (In English)

The concept of families of extremal hypersurfaces enables a definition of quasi-inertial coordinate systems in terms of which covariant, local conservation laws for energy-momentum are formulated. Four supplementary metric tensor components are eliminated, and a canonical quantization of the gravitational field is performed. (auth)

21145 ON AN ABSOLUTE PARAMETER FOR MEASUREMENT OF THE DEGREE OF DEVELOPMENT OF NUCLEAR EMULSIONS. I. COMPARATIVE STUDY OF ILFORD C2 AND K2 EMULSIONS. J. Catalá, J. Casanova, F. Senent, E. Villar, P. Tárrega, and R. Díez (Centro de Física Fotocorpuscular, Facultad de Ciencias, Valencia). Anales real soc. espán. fís. y quím. (Madrid), Ser. A, 58: 23-6(Jan.-Feb. 1962). (In Spanish)

An absolute parameter is introduced to define the degree of development of nuclear emulsions. The values of the index for Ilford C2 and K2 emulsions are compared when both emulsions are developed at the same temperature for the same time. (auth)

21146 SCATTERING GENERAL ANALYSIS. Alberto Galindo Tixaire (Junta de Energia Nuclear, Madrid). Anales real soc. espán. fís. y quím. (Madrid), Ser. A, 58: 37-50(Jan.-Feb. 1962). (In Spanish)

An explanation is presented of some results obtained referring to the mathematical aspects of the theory of dispersion. An introduction is given to various pure mathematical concepts which result in methods for analyzing the fundamental questions which cause the problems of dispersion. The questions are examined fully, including all the integral representations and equations of dispersion. (tr-auth)

21147 OPTICAL SPECTRA EXCITED IN HIGH PRESSURE NOBLE GASES BY ALPHA IMPACT. W. R. Bennett, Jr. (Columbia Univ., New York and Yale Univ., New Haven). Ann. Phys. (N. Y.), 18: 367-420(June 1962).

The atomic spectra observed in the pure noble gases are interpreted through the dominant processes of direct excitation by alpha and electron impact, viz. trapping of vacuum ultraviolet resonance radiation and excitation transfer effects resulting from two-body collisions with ground-state atoms. The pressure dependence of helium line intensities may be explained with effective depletion cross sections that are in the order of 10^{-15} cm^2. The absolute intensities emitted from helium are in approximate agreement with cross sections calculated from the Born approximation, if allowance is made for the collision effects. The results indicate that the light emitted from atomic transitions in all the noble gases between 2400 and 5500 Å represents a negligible fraction of the total excitation. No evidence is found for a recombination spectrum in any of the gases. The weak lines observed in pure helium and neon are identified as atomic transitions that are normally present in the discharge spectrum at low pressures. Two weak, unidentified lines of equal intensity are found in pure argon at 3083 ± 3 and 3094 ± 3 Å. In pure krypton and xenon, broad diatomic molecular bands are found to dominate the spectrum. The integrated photon counting rates for pure xenon, krypton, argon, neon, and helium are in the ratio 240:90:3:3:1 at 350 mm Hg. Nitrogen impurity bands dominate the spectra in most helium, neon, and argon samples used, and the sensitivity to nitrogen is in that order. First negative bands of N_2^+ are encountered in helium and neon, and the second positive bands of N_2 are found in argon. It is concluded that the following nitrogen excitation mechanisms are dominant: charge exchange with the molecular ion He_2^+ in the case of helium; collision with a high excited state, probably 4^3P_2 or 4^3P_1, in the case of neon; and collision with the $^3P_2$ metastable level in the case of argon. The 0,0 N_2^+ band dominates the helium spectrum for less than one part N_2 in 10^5 at 350 mm Hg. The results in Ne–N_2 mixtures place an upper limit on the available energy from thermalized Ne_2^+ ions of 18.75 ev. The relative $C^3\pi_u$ populations observed in the Ar–N_2 mixtures are approximately those expected if the Franck-Condon principle is obeyed in the collision excitation from the nitrogen ground state. Only the second positive bands are observed in high-pressure reagent grade nitrogen and the intensities are weaker than those found in the Ar–N_2 mixtures. Comparisons are given between calculated and measured relative transition probabilities for most of the nitrogen bands observed. The relation between these measurements, average-energy-per-ion-pair measurements, and gas-scintillation-counter measurements is discussed. (auth)

21148 RPA INSTABILITY AND THE GAS-LIQUID TRANSITION. PART I. N. David Mermin (Univ. of Birmingham, Eng.). Ann. Phys. (N. Y.), 18: 421-53(June 1962).

The possibility of a many-particle system undergoing a classical gas–liquid phase transition is shown to be reflected in the structure of the two-particle Green's function in the random phase approximation. When the interaction is sufficiently attractive this Green's function possesses forbidden poles on the imaginary axis of the complex frequency plane. An investigation of the temperature dependent correlation function reveals that the poles appear even in the classical limit, and that as they appear $(\partial P/\partial V)_T$ vanishes and long range density correlations of the form usually associated with critical fluctuations arise. It is therefore concluded that the poles are symptomatic of the instabilities associated with the condensation of the system from a gaseous to a liquid phase. (auth)

21149 RPA INSTABILITY AND THE GAS–LIQUID TRANSITION. PART II. EFFECT OF SHORT RANGE REPULSION. N. David Mermin (Univ. of Birmingham, Eng.). Ann. Phys. (N. Y.), 18: 454-79(June 1962).

The complex poles of the two-particle correlation function occurring in the random phase approximation (RPA) for an attractive interaction can be interpreted in the classical limit as indications that the approximation fails as a result of the huge correlations associated with condensation. The argument, however, is not complete, since the poles occur at arbitrarily high temperatures if the density is great enough. Physically, it is suspected that strong short-range intermolecular repulsion is responsible for the existence of a critical temperature above which condensation does not occur. Correspondingly, it is shown that when the RPA is suitably improved to take short-range repulsion into account, there arises a critical temperature above which complex poles never occur. In the improved solution below the critical temperature the poles appear as the density increases, but–in contrast to results obtained with the RPA–disappear again at still higher densities. Thus the poles are confined to a region of the T–V plane having the structure of a classical two-phase region. (auth)

21150 DECAY AND BUILD-UP OF LUMINESCENCE OF ZnS: Cu, Cl. Toshio Yoshida. Ann. Rept. Radiation Center Osaka Prefect., 2: 78-84(1961). (In English)

Luminescence build-up and decay measurements are reported for cubic and hexagonal ZnS crystals activated with from 0 to 0.01 wt % Cu. The results indicate that a sample having a large decay rate has also a large build-up rate and that decays and build-up on the shorter wavelength side are faster than those on the longer wavelength side. The effects of Cu content on the blue and green bands are discussed. (D.L.C.)

21151 TWO-FLUID MAGNETOHYDRODYNAMIC CYCLE FOR NUCLEAR-ELECTRIC POWER CONVERSION. David G. Elliott (Jet Propulsion Lab., Pasadena, Calif.). ARS (Am. Rocket Soc.) J., 32: 924-8(June 1962).

To circumvent the high temperatures required in a magnetohydrodynamic power conversion system employing a plasma as the conductor, it is proposed that a liquid metal be employed as the conductor, the metal being accelerated by the vapor of a second fluid in a two-phase nozzle and extracted by a liquid-gas separator. It is estimated that a cycle efficiency of 10% is attainable at a radiator-to-reactor temperature ratio of 0.7. The specific weight of such a two-fluid MHD conversion system would be about the same as that of a turboelectric system. (auth)

21152 EXPERIMENTAL INVESTIGATION OF ION BEAM NEUTRALIZATION BY COAXIALLY INJECTED ELECTRONS. W. L. Stirling (Oak Ridge National Lab., Tenn.). ARS (Am. Rocket Soc.) J., 32: 929-33(June 1962).

A model of an ion source for producing large space-charge-neutralized beams is presented. Experiments show that coaxially injected electrons overcome space charge, thereby increasing ion output. Ideally, ions and electrons emerge together with the same density and velocity, forming a neutralized beam. (auth)

21153 THE RESISTOJET. James M. Howard (Marquardt Corp., Van Nuys, Calif.). ARS (Am. Rocket Soc.) J., 32: 961-2(June 1962).

The resistojet is an electrothermal propulsor based on the principle of heating a propellant by convective heat transfer from refractory resistance elements. The thermal energy in the propellant is converted to directed kinetic energy by expansion through a nozzle. (auth)

21154 ERRORS DUE TO DIFFUSION IN DRIFT VELOCITY MEASUREMENTS. J. J. Lowke (Australian National Univ., Canberra). Australian J. Phys., 15: 39-58 (Mar. 1962).

An analysis of errors due to diffusion in measurements of the drift velocity of electrons in gases is made using the methods of Bradbury and Nielsen, Pack and Phelps, and Hornbeck. The influences of back diffusion and the effect of the boundary condition imposed by the receiving electrode are considered. In the method of Bradbury and Nielsen, effects due to diffusion can lead to spuriously high measurements of the drift velocity introducing a relative error of 3/h(W/D) (h being the distance between the shutters and W/D the ratio of the drift speed to the diffusion coefficient). Results support the theoretical predictions. For E/p = 0×4 v cm^{-1} mm Hg^{-1}, the measured value of the drift velocity rose by 13% in He and 8% in N as the coefficient of diffusion was increased. (auth)

21155 ELECTRONIC SIMULATION OF THE EFFECT OF LENS ABERRATIONS ON ELECTRON BEAM CROSS SECTIONS. P. W. Hawkes and V. E. Cosslett (Univ. of Cambridge, Eng.). Brit. J. Appl. Phys., 13: 272-9(June 1962).

The curve in which an electron beam intersects an arbitrary plane, after being focused in a non-rotationally-symmetric field, can be represented by the sum of a series of sine and cosine terms. The frequencies, amplitudes, and relative phases of these terms are determined by the position of the beam in the object and aperture planes, and also by the values taken by four parameters (positive and negative integers). These parameters are related on the one hand to the order of rotational symmetry of the field, and on the other hand to the order of the various aberrations. A table is given of the values taken by the parameters for the various aberrations of fields of different orders of symmetry. The aberration figure in any cross section of the imaging beam can be displayed on the screen of an oscilloscope if the voltages applied to its X and Y plates are proportional to the sum of the sine and cosine terms (respectively) which represent the assumed form of the field. By means of a defocusing control, the form of an aberration can be explored in any part of the 'caustic.' Also it is possible using the oscilloscope-display method to simulate the simultaneous presence of several aberrations. The necessary circuits for generating and mixing the component voltages are described and examples are given of the effect of combining particular aberrations. A procedure is outlined for reproducing the form of the aberrations when the aperture is not circular, but can be defined by circular arcs. Finally

it is shown how expressions for the magnitudes of the various aberration coefficients can be obtained by a perturbation method. (auth)

21156 SECONDARY EMISSION FROM THE BOMBARDMENT OF MOLYBDENUM WITH NEUTRAL ARGON ATOMS AND WITH ARGON IONS. U. A. Arifov, R. R. Rakhimov, and Kh. Dzhurakulov (Inst. of Nuclear Physics, Academy of Sciences, Uzbek SSR). Doklady Akad. Nauk S.S.S.R., 143: 309-11(Mar. 11, 1962). (In Russian)

A narrow ion beam of a given energy was formed by means of a cylindrical condenser and two identical electrostatic lenses, and directed along the axis of a nickel cylinder 100 mm in length which acted as a charge transfer chamber. The measuring part of the equipment consisted of a protective cylinder, a spherical collector (d = 50 mm) and a molybdenum foil target (0.015 by 5 by 30 mm). The intensity of neutral atoms in the beam was determined as the difference in intensity of the ion beam to the target before and after sending the gas into the charge transfer chamber. At an energy of 500 ev the value of the secondary emission for electrons γ is very small for Ar^0 (neutral atoms), while γ is 10 to 12% for Ar^+ (positive ions). The value of the secondary electron emission increases with energy on bombarding the Mo target with neutral Ar atoms having energies of 1100 ev and 1800 ev. No secondary or reflected positive ions were observed. The value of γ is given as a function of energy for Ar atoms and for Ar^+ at energies of 0.2 to 2.0 kev. (TTT)

21157 THE AVERAGE DENSITY METHOD OF CALCULATING THE MOTION OF CHARGED PARTICLES ON A DIGITAL COMPUTER. S. P. Lomnev (Steklov Mathematics Inst., Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R., 143: 1309-12(Apr. 21, 1962). (In Russian)

Direct integration of the kinetic equations in the problem of many bodies can be performed on a digital computer by decreasing the number of equations required. The charge density $\rho(x,y,z,t)$ is calculated from the configuration of a finite number of tentative charged particles whose motion is determined on the computer. The charge space is subdivided into small charge volumes $\Delta x\Delta y\Delta z = \Delta V$, and integrated over the potential of the field. The motion of a particle in a synchrocyclotron at the Central Institute of Nuclear Studies was investigated by this method. The calculations show that the limiting charge, which can be maintained without losses, is of the order of 5×10^{-5} a. The radial phase oscillations lead to a "phase jump." The selection of proper intervals and method of calculation are illustrated. (TTT)

21158 THE KINETICS OF QUENCHING IN LIQUID SCINTILLATORS. B. L. Funt and A. Hetherington (Univ. of Manitoba, Winnipeg, Can.). Intern. J. Appl. Radiation and Isotopes, 13: 215-21(Apr. 1962). (In English)

The kinetics of the quenching process were studied for two efficient solvents, monoisopropylbiphenyl and toluene, over a range of solute concentrations. It was found that the Stern-Volmer relationship was applicable and quenching constants were obtained for carbon tetrachloride, diphenyl mercury, and lead-2-ethyl hexanoate in each solvent. The quenching constants were significantly lower in monoisopropylbiphenyl than in toluene. A kinetic scheme for the probable steps in the energy transfer process was formulated, and by the application of steady-state kinetics several experimentally verifiable postulates were obtained. These were tested and confirmed by the experimental data obtained from the variation of quencher constants with solute concentrations. Some useful observations relating to the optimum formulation of loaded liquid scintillators in nuclear radiation detectors can also be made from the results. (auth)

21159 THEORY OF MAGNETIC ROTATION SPECTRA. H. F. Hameka (Johns Hopkins Univ., Baltimore). J. Chem. Phys., 36: 2540-7(May 15, 1962).

A general theory was developed for optical and magneto-optical rotation in the case of resonance, that is, if the frequency ν of the primary light is equal to an absorption frequency ν_k of the system. It was concluded that for this case optical and magneto-optical rotatory power are physically meaningless quantities since they cannot be measured; instead the total intensities of the emission lines in optical rotation spectra or magnetic rotation spectra should be considered. General formulas for these intensities were derived from the quantum theory of radiation fields by making use of a perturbation method that was introduced by Heitler and Ma for the description of damping phenomena. An important feature of the method is the introduction of a damping constant which causes the results to remain finite for $\nu = \nu_k$; this was not the case in the older theories. The possibility of measuring optical rotation spectra is mentioned: it is predicted that they may be observed in dilute gases of optically active molecules. No applications of the general theory to specific molecules are given. (auth)

21160 ON PLANE LINEAR MAGNETOHYDRODYNAMIC WAVES. Leon Trilling (Massachusetts Inst. of Tech., Cambridge). J. Fluid Mech., 13: 272-88(June 1962).

The perturbation modes of the steady parallel flow of a compressible fluid of finite constant viscosity and electrical conductivity in a uniform, arbitrarily oriented magnetic field are examined. In particular, in addition to the classical fast and slow sound and Alfvén modes, some waves are obtained whose amplitude is finite whenever the diffusive coefficients are finite and which resemble the diffusion of vorticity from stream surfaces in classical hydrodynamics. Upward-facing MHD waves and upstream wakes are re-interpreted. (auth)

21161 FOUNDATIONS OF QUATERNION QUANTUM MECHANICS. David Finkelstein (Yeshiva Univ., New York), Josef M. Jauch, Samuel Schmiminovich, and David Speiser. J. Math. Phys., 3: 207-20(Mar.-Apr. 1962).

A new kind of quantum mechanics using inner products, matrix elements, and coefficients assuming values that are quaternionic (and thus noncommutative) instead of complex is developed. This is the most general kind of quantum mechanics possessing the same kind of calculus of assertions as conventional quantum mechanics. The role played by the new imaginaries is studied. The principal conceptual difficulty concerns the theory of composite systems where the ordinary tensor product fails due to noncommutativity. It is shown that the natural resolution of this difficulty introduces new degrees of freedom similar to isospin and hypercharge. The problem of the Schrödinger equation, "which i should appear?" is studied and a generalization of Stone's theorem is used to resolve this problem. (auth)

21162 SOME EXAMPLES OF CANONICAL TRANSFORMATIONS IN QUANTUM MECHANICS. Francis R. Halpern (Princeton Univ., N. J.). J. Math. Phys., 3: 281-6 (Mar.-Apr. 1962).

The set of all pairs of polynomials X(x,p) and P(x,p) in the position x and momentum p are found such that X and P have the same commutator as x and p. Other types of representations of the commutation relations are studied. The reducibility, time, and space inversion properties of these are discussed. The unitary transformations connecting different representations are exhibited. The use of different

representations to solve scattering and bound-state problems is indicated. The application of one of the transformations to a partial diagonalization of a perturbed harmonic oscillator Hamiltonian is made. (auth)

21163 DERIVATION OF ADMISSIBILITY CONDITIONS FOR WAVE FUNCTIONS FROM GENERAL QUANTUM-MECHANICAL PRINCIPLES. Dave Pandres, Jr. (Martin Co., Denver). J. Math. Phys., 3: 305-8(Mar.-Apr. 1962).

Admissibility conditions for wave functions are derived from general quantum-mechanical principles. The conditions apply in general curvilinear coordinates to functions that describe general N-particle systems. They restrict the behavior of wave functions so severely as to suggest that the Hilbert space of ordinary quantum mechanics cannot be enlarged unless the fundamental principles of quantum mechanics are modified. One of the conditions implies that all particles must be either fermions or bosons, i.e., that no particles obeying intermediate statistics can exist. (auth)

21164 SYMMETRIES OF THE EINSTEIN-MAXWELL EQUATIONS. Gerald Rosen (Martin Co., Baltimore). J. Math. Phys., 3: 313-18(Mar.-Apr. 1962).

Space-time symmetries admissible according to the Einstein-Maxwell equations are analyzed from the standpoint of the groups of motions in Rainich geometry. Necessary and sufficient conditions for a motion are expressed in terms of the Ricci vierbein of principal directions. Normal Rainich geometries, for which the Ricci congruences are orthogonal to four sets of hypersurfaces, are studied. First integrals to the Rainich conditions are presented for the latter class of geometries. A new solution to the Einstein-Maxwell equations is derived in the form of a spatially-homogeneous Rainich geometry. (auth)

21165 CONTINUUM COULOMB WAVE FUNCTION. W. R. Johnson and R. T. Deck (Univ. of Notre Dame, Ind.). J. Math. Phys., 3: 319-24(Mar.-Apr. 1962).

An alternate form for the continuum-state relativistic Coulomb wave function is developed which expresses the spin dependence in terms of the usual Dirac plane-wave spinor. The computational convenience of this form is indicated by a direct derivation of the Sommerfeld-Maue approximation. (auth)

21166 THEORY OF TRANSPORT COEFFICIENTS. I. GENERAL THEORY AND ELECTRICAL CONDUCTIVITY OF ELECTRON-PHONON SYSTEM. S. Fujita and R. Abe (Northwestern Univ., Evanston, Ill.). J. Math. Phys., 3: 350-9(Mar.-Apr. 1962).

A general method is presented for the calculation of static transport coefficients based on Kubo's formulas. Techniques of perturbation expansion, diagram representation, and linked-cluster expansion are used. The electrical conductivity of an electron-phonon system is calculated using the natural introduction of irreversibility. Under certain conditions, this method is equivalent to the conventional method by the Boltzmann equation. These conditions are examined, and the improvement of the approximation is discussed. (auth)

21167 THEORY OF TRANSPORT COEFFICIENTS. II. VISCOSITY COEFFICIENTS OF QUANTUM GASES OBEYING THE BOLTZMANN STATISTICS. S. Fujita (Université Libre, Brussels). J. Math. Phys., 3: 359-67(Mar.-Apr. 1962).

The viscosity coefficients of a weakly-coupled and a dilute quantum gas, both obeying the classical statistics, are calculated. Transport coefficients are calculated from exact formulas of Kubo using the natural introduction of the irreversibility. It is shown explicitly that the low-density limit as well as the weak-coupling limit of the viscosity are those expected from the conventional calculation via the Boltzmann equation. The nature of these limits is closely related to the two well-separated time scales—average duration of collision and average time between successive collisions. (auth)

21168 LONG-TIME BEHAVIOR OF A RANDOM LATTICE. Jun-ichi Hori (Hokkaido Univ., Sapporo, Japan). J. Math. Phys., 3: 382-6(Mar.-Apr. 1962).

The time-dependent behavior of a linear isotopic random lattice is studied. The asymptotic average value of the solution of the equation of motion for the amplitude z_k of a normal mode of the virtual regular lattice, composed of atoms with mass equal to the harmonic average of those of the isotopes, is calculated in the limit $N \to \infty$, $t \to \infty$, $\gamma_n \to 0$, and $\gamma_n t$ = a finite constant ($n = 1,2,\ldots$). Here N is the number of normal modes, and γ_n the nth cumulant of the distribution of inverse mass. The initial conditions are $z_j(0) = \delta_{kj}$ and $(dz_j/dt)_{t=0} = 0$ ($j = -N/2 + 1, -N/2 + 2, \ldots, N/2 - 1, N/2$). The result is

$$(z_k) = \exp(-i\alpha\omega_k + \sum_{n=1}^{\infty} \gamma_{2n} Q_k^n q^{n-1}/n!)t,$$

where $\alpha\omega_k = 2f^{1/2}3\mathfrak{M}\omega_k$ (f: force constant, $3\mathfrak{M}$: average inverse mass) is the eigenfrequency of the kth normal mode, $Q_k = 8i\omega_k f^2/\alpha^3$, and $q = t/N$, assumed to be a constant. If $q \to 0$, there remains only the first term, and the result coincides with that for a Gaussian distribution. (auth)

21169 NUCLEAR QUADRUPOLE FRS RESONANCE AND ITS APPLICATION. Georges Boudouris (Université, Paris). J. phys. radium, 23: 43-59(Jan. 1962). (In French)

Nuclear quadrupole resonance is a recent branch of radiofrequency spectroscopy; it is exploited in the study of the solid state (crystal structure, chemical bond, intramolecular motions, etc.). After a statement of the theoretical basis of the phenomenon and the principles of the experimental methods of observation, the various applications and the main results obtained, during the first twelve years of research, 1950–1961, are reviewed. (auth)

21170 MEASUREMENT OF MASS PER UNIT AREA BY THE FORWARD SCATTERING OF LOW ENERGY BREMSSTRAHLUNG. W. Kuehn (Isotopen-Studiengesellschaft e.V., Institut, Karlsruhe, Ger.). Kerntechnik, 4: 54-5(Feb. 1962). (In German)

A technique for measuring the mass per unit area or the moisture content by the forward scattering of γ rays produced in the material to be measured by low-energy bremsstrahlung is described. Because of the varying silver content for various exposure times of film emulsions, the technique can also be used to determine density graduations of developed negatives, the high densities corresponding to high radiation intensities. (auth)

21171 DOSIMETRY BY MEANS OF THERMOLUMINESCENCE OF LITHIUM FLUORIDE. P. Braeunlich and A. Scharmann (Universität, Giessen, Ger.). Nukleonik, 4: 65-7(Mar. 1962). (In German)

The thermoluminescence of LiF single crystals after excitation by γ radiation and thermal neutrons was investigated, and the significance with respect to dosimetry is discussed. (tr-auth)

21172 ON QUANTUM-MECHANICAL ERGODICITY CONDITIONS IN CONNECTION WITH AVERAGING METHODS. S. Grossmann (Universität, Berlin). Nuovo cimento (10), 24: 201-13(Apr. 16, 1962). (In English)

Ergodicity conditions obtained by an averaging procedure are studied. In linear theorems this method is equivalent to using statistical mixtures of projector-type instead of

pure ensembles. Conditions proposed by Prosperi and Scotti are clarified to give a relation between some arbitrary subspace b and the Hamilton operator H: if and only if b is turned uniformly throughout the energy shell, it satisfies the ergodicity conditions. An equivalent statement is $|P_b\varphi_\rho|^2 \approx s/S$ for every energy eigenvector φ_ρ. (auth)

21173 ON STRUCTURE OF THE ALGEBRA OF FIELD OPERATORS. H.-J. Borchers (Inst. for Advanced Study, Princeton, N. J.). Nuovo cimento (10), 24: 214-36(Apr. 16, 1962). (In English)

Fields described by Wightman functions are investigated. For irreducible fields, the lowest energy state does not degenerate. A necessary and sufficient condition for the irreducibility of the field, in terms of Wightman functions, is derived. For reducible fields, the algebra of all operators commuting with the field is an abelian algebra; its elements commute with the representation of the inhomogeneous Lorentz-group. (auth)

21174 EXPERIMENTAL TESTS OF THE FERMI-TELLER "Z-LAW". M. Eckhause (Carnegie Inst. of Tech., Pittsburgh), T. A. Filippas, R. B. Sutton, R. E. Welsh, and T. A. Romanowski. Nuovo cimento (10), 24: 666-71(May 16, 1962). (In English)

Experimental studies were made of the ratios of atomic capture probabilities for μ^- mesons in BiF_3, UF_4, and in a Cu-Al alloy, in an attempt to test the Fermi-Teller "Z-Law". The measured atomic capture ratios were: BiF_3 = 1.58 ± 0.15, U/F_4 = 1.52 ± 0.15, and Cu/Al_2 = 2.08 ± 0.25 by one method, and by another method, Cu/Al_2 = 1.75 ± 0.18. The "Z-Law" predicted 3.07, 2.56, and 1.11 for BiF_3, UF_4, and $CuAl_2$ respectively. Some μ^- meson total disappearance rates were also measured. (auth)

21175 POSITRON ANNIHILATION IN WATER AND ICE WITH AN EXTERNAL MAGNETIC FIELD. G. Iaci, I. F. Quercia, and E. Turrisi (Università, Catania and Istituto Nazionale di Fisica Nucleare, Catania, Italy). Nuovo cimento (10), 24: 746-56(May 16, 1962). (In English)

The angular distribution of 2γ annihilation of positrons in water and in ice is measured with a 15-kgauss magnetic field. The magnetic field enhances the narrow component of the angular distribution in water. The angular distribution in ice seems not to be influenced by the magnetic field. (auth)

21176 THEORY OF BLOCH ELECTRONS IN A MAGNETIC FIELD. L. M. Roth (Massachusetts Inst. of Tech., Lexington). Phys. and Chem. Solids, 23: 433-46(May 1962). (In English)

An effective Hamiltonian is obtained for a Bloch electron in a magnetic field. Using a basis set of modified Bloch functions, a momentum-space Schrödinger equation is first obtained, which is formally exact but which has interband terms and also has a normalization matrix differing from the unit matrix. A non-unitary transformation is then used to obtain a one-band Hamiltonian to any order in the magnetic field, and this is carried out to second order for at most two-fold degenerate bands including spin-orbit interaction. The result is applied to a determination of the normal magnetic susceptibility of Bloch electrons. (auth)

21177 EQUILIBRIUM PROPERTIES OF HYDROGEN GAS FROM 5000° TO 20,000°K. O. Sinanoğlu (Yale Univ., New Haven), M. S. Vardya, E. M. Mortensen, and W. C. Johnson, Jr. Phys. Fluids, 5: 665-71(June 1962).

Equilibrium properties of hydrogen gas are calculated from 5000° to 20,000°K by considering it as a monatomic gas with imperfections. The "H_2 and H equilibrium" method is not suitable at high temperatures, even with anharmonicity corrections. Properties are obtained from the second virial coefficient B(T) of the monatomic gas and its derivatives. For the $^1\Sigma$ state the Rydberg potential and for the $^3\Sigma$ the best numerical potential is used. Ionization, higher excited states, and quantum effects are examined. The third virial coefficient for H_2 is estimated, and properties from B(T) part alone are sufficient to 1000 at 10,000 and 13,000 atm at 20,000°K. Results are compared with those of the "equilibrium constant" approach. (auth)

21178 MAGNETO-GAS-DYNAMIC SHOCK WAVES IN A GAS WITH VARIABLE CONDUCTIVITY. J. B. Helliwell and D. C. Pack (Royal Coll. of Science and Tech., Glasgow). Phys. Fluids, 5: 738-40(June 1962).

Basic equations are given by jump relations and Ohm's law. They are valid for deflagration and detonation problems in which exothermal energy is liberated at the wave front. If the electric field is eliminated from the jump relations, there are more independent variables on the downstream side of the shock wave than jump equations. (L.N.N.)

21179 VOLUME RECOMBINATION, CONSTRICTION, AND VOLT-AMPERE CHARACTERISTICS OF THE POSITIVE COLUMN. Carl Kenty (General Electric Lamp Research Lab., Cleveland). Phys. Rev., 126: 1235-8(May 15, 1962).

Positive characteristics have been found for diffuse, striation-free, 1 to 20 ma dc, positive columns in 150-mm Xe, Kr, or Ar, with 0.1% N_2 in 10-cm tubes. With Xe + N_2, a continuous spectrum is emitted; with other rare gases selections of N_2 bands. The positiveness of the characteristic results from (1) the disappearance of ions principally by dissociative recombination and (2) ionization which is in effect single stage. For similar current densities the gradient varies little with tube diameter. Probe measurements indicate that the electron and ion density has a relatively flat distribution over a large central part of the tube as compared with the Bessel distribution; the latter resulting from ion loss to the walls by ambipolar diffusion. This broadening out of the discharge increases with the current. For steady convection-free discharges where volume recombination and diffusion are both contributing to ion loss, the degree of constriction should be governed by a "constriction number" C given by $C = D_\alpha/\alpha R^2 n_e$, where D_α is the ambipolar diffusion constant, α is the recombination coefficient (supposed constant everywhere), R is the tube radius, and n_e the ion concentration. When the current is increased beyond a critical value, the discharge changes abruptly to a filamentary form, the same whether N_2 is present or not, having a several-fold lower gradient, a negative characteristic, and emitting mainly the line spectrum of the rare gas. This discharge is believed to be diffusion and convection controlled, the (atomic) ions diffusing from the hot core to the cooler periphery where they form molecular ions and recombine dissociatively. Such a mechanism as the above, involving a temperature gradient favoring the existence of molecular ions and dissociative recombination in the outer regions is believed to account quite generally for constriction greater than that corresponding to the Fabrikant-Spenke curve. (auth)

21180 SOME REMARKS ON CORRELATIONS IN CLASSICAL ORDER-DISORDER PHENOMENA. Frank H. Stillinger, Jr. (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev., 126: 1239-50(May 15, 1962).

By means of a spin-magnitude variation parameter, equations are derived for spin-pair correlation functions in

classical lattice theories. Specifically, the case of two spin states present in equal average numbers is considered, but with arbitrary scalar interaction between pairs of spin sites. It is pointed out that in this case the spin-triplet correlation functions which occur in the theory, as well as all higher odd-order correlation functions, may be reduced exactly to linear combinations of lower-order correlation functions. The nature of spin-quadruplet correlations, which are also required in this method for rigorous determination of the pair functions, unfortunately have no corresponding reduction, but their character is discussed qualitatively. The approximate theory resulting from use of a simple closure relation for quadruplets is examined, with particular attention to the position of the critical temperature for ferromagnetic coupling of varying range. It is remarked, on the basis of the approximate theory, that spin-pair correlations at large distance tend to become independent of direction (relative to the fundamental axes of the lattice) as the critical temperature is approached, when the interaction satisfies a certain second-moment isotropy condition. An alternative, and apparently more accurate, closure relation for determination of spin-quadruplet correlation functions is proposed with a view toward possible application to modern computing techniques. (auth)

21181 FUNCTIONAL DERIVATIVE TECHNIQUES IN THE THEORY OF SUPERCONDUCTIVITY. Stanley Engelsberg (Univ. of Illinois, Urbana). Phys. Rev., 126: 1251-61(May 15, 1962).

The equations for the Green's functions of the theory of superconductivity are developed in an iterative scheme in which the two-particle function is rewritten as the functional derivative of the single-particle function with respect to external-source terms. When a source coupled to electron pairs in addition to an external potential coupled to the charge density is included in the Hamiltonian, the possibility for a gap in the single-particle excitations is found. The first order in the iteration scheme for the solution to the Green's function equations is independent of the way in which the two-particle function is generated, as the final result must be. Equations for the vertex functions are obtained and used to find the linear response of the current to an applied electromagnetic field. An exact solution to the vertex equation of interest is used to show that no current will be induced by a static longitudinal vector potential. In addition, all the functions calculated are found to have translationally invariant solutions. Thus, the original invariances of the Hamiltonian are restored when the source terms are set equal to zero. Corrections to the self-energy are estimated by using another of the solutions to the vertex equations. (auth)

21182 ENERGY LOSSES AND COLLECTIVE EXCITATIONS IN A CRYSTAL. Stanley Engelsberg (Univ. of Illinois, Urbana). Phys. Rev., 126: 1262-7(May 15, 1962).

The relation which exists between the Coulomb energy losses of an electron passing through a crystal and the absorption of light by the same crystal is examined in the Born approximation. It is found that at long wavelengths the validity of the Born approximation is the only necessary criterion for the equality of the corresponding averaged matrix elements. The coupling of an incident electron to the collective modes of a crystal is next considered. The modifications of previous results for the transition probability, required by the presence of a crystal structure, are discussed. When the possibilities for Bragg scattering are extracted, a single function is found to describe the energy losses of a fast incident particle. Although simple band models may be chosen, approximations equivalent to the random-phase approximation lead to a result which retains the possibility of describing observed complex absorption spectra. It is demonstrated how a collective mode of the system may appear when the imaginary part of the polarizability varies from zero sufficiently rapidly. (auth)

21183 SPUTTERING EXPERIMENTS IN THE RUTHERFORD COLLISION REGION. Manfred Kaminsky (Argonne National Lab., Ill.). Phys. Rev., 126: 1267-70(May 15, 1962).

Sputtering experiments have been conducted by bombarding the (110) plane and the (100) plane of single crystals of copper by deuterons incident normally with energies from 0.8 to 2.5 Mev from a Van de Graaff accelerator. Electron micrographs showed that surface etch pits were formed by bombardment, even at these high energies. Measurements of optical transmission of the sputtered film collected on a quartz tube indicated a deviation from a cosine distribution in the energy range investigated. For 800-kev deuterons bombarding a (100) plane in Cu, the absolute value of the sputtering ratio was $S = 1.1 \times 10^{-3}$ atom/ion at 25° with respect to the surface normal and 5.8×10^{-4} angles larger than 40°; and $S < 0.9 \times 10^{-3}$ atom/ion at 25° for 1.5-Mev deuterons. For 0.80- and 2.5-Mev deuterons bombarding a (110) plane, $S < 5 \times 10^{-3}$ atom/ion. These data agree with the calculations of Goldman and Simon and of Pease within a factor of 2, but disagree with those reported by Pleshivtsev by 2 to 4 orders of magnitude. The sputtering ratio was found to decrease with increasing ion energy, in qualitative agreement with the theoretical predictions but contrary to the findings of Pleshivtsev. (auth)

21184 NUCLEAR SPIN-LATTICE RELAXATION IN SUPERCONDUCTING ALUMINUM ALLOYS. Yoshika Masuda (Columbia Univ., New York). Phys. Rev., 126: 1271-4(May 15, 1962).

The nuclear spin-lattice relaxation time, T_1, of superconducting aluminum alloys which contain up to 0.16% zinc or germanium has been measured in the range of 0.37°K to 1.2°K. A field cycling method was used. T_1 decreases slightly (less than 30%) with increasing-impurity concentration. The experimental data indicate that the anisotropy of the energy gap decreases with increasing reciprocal mean free path. The results are explained by means of the theory of dirty superconductors introduced by Anderson. (auth)

21185 ANHARMONIC CONTRIBUTIONS TO SPECIFIC HEAT. Joseph M. Keller and Duane C. Wallace (Ames Lab., Ames, Iowa). Phys. Rev., 126: 1275-82(May 15, 1962). (IS-391).

At temperatures appreciably above the Debye temperature, anharmonic parts of the lattice potential of a crystal make a contribution to the specific heat at constant volume that is nearly linear with the temperature, but of uncertain sign. Calculations on bcc and fcc crystals with a single atom per unit cell, based on central Lennard-Jones forces, show that the net effect is one of specific heat decreasing as temperature increases. The complicated sums involved can be simplified by use of a matrix inverse to the harmonic dynamical matrix, or by neglecting the dependence of phonon frequency on polarization. The latter method is used here. Forces between nearest and next-nearest neighbors are considered, and phonon dispersion is included approximately. (auth)

21186 DYNAMICS OF CUBIC CRYSTALS WITH A LOCAL CHANGE OF MASS. G. F. Nardelli (C.N.E.N., Ispra, Italy and Gruppo Fisica dei Solidi, Milan) and N. Tettamanzi. Phys. Rev., 126: 1283-92(May 15, 1962).

The effects of a local change of mass on lattice vibrations of cubic systems are discussed for simple Bravais lattices, on the basis of the harmonic theory of crystal dynamics. It is shown that the change of any extensive property, as well as the values of the discrete frequencies, are given in terms of simple expressions involving only the distribution function $G_\beta(\omega^2)$ of the square frequency for the unperturbed lattice; the theoretical expressions are found to be equivalent to those holding for linear chains, provided that the distribution function is normalized to one. Perturbative techniques are discussed in some detail; it is found that a perturbative expansion of the change of any extensive property converges to the right value, provided the fractional change of mass, $\epsilon = -(M' - M)/M$, lies inside the range from $-\infty$ to $+\frac{1}{2}$. Some applications are carried out starting from Overton's distribution function for a fcc lattice: a discrete frequency, threefold degenerate, is found to occur for $\epsilon \geq 0.215$, and the self-entropy of a substitutional impurity (neglecting the influence of the elastic distortion) is shown to be related only to the structure of the distribution function, in the high-temperature limit; this change of entropy is evaluated for several light impurities. Finally, arguments are presented which suggest that the contribution to the self-entropy of a vacant lattice site, arising from the loss of coupling with the neighbors, may be higher than was estimated by Huntington and co-workers. (auth)

21187 RADIATION-INDUCED RECOMBINATION AND TRAPPING CENTERS IN GERMANIUM. II. ANNEALING IN GAMMA-IRRADIATED, ANTIMONY-, AND ARSENIC-DOPED MATERIAL. O. L. Curtis, Jr. and J. H. Crawford, Jr. (Oak Ridge National Lab., Tenn.). Phys. Rev., 126: 1342-9(May 15, 1962).

An investigation has been made of the annealing properties of radiation-induced recombination centers in germanium. The annealing behavior of antimony-doped germanium is grossly different from that of arsenic-doped material. The experimental observations are explained on the following basis: The recombination level at 0.36 ev above the valence band belongs to the vacancy. In antimony-doped material the vacancy disappears by association with an antimony atom. This process does not occur in arsenic-doped material, and higher temperatures are required to produce annealing. It is thought that a trapping level, present only in arsenic-doped material, located 0.10 ev above the valence band might be due to an arsenic-interstitial pair. (auth)

21188 SPIN-LATTICE RELAXATION TIME OF SAMARIUM ETHYL SULFATE. R. Orbach (Harvard Univ., Cambridge, Mass.). Phys. Rev., 126: 1349-51(May 15, 1962).

The spin-lattice relaxation time T_1 of Sm^{3+} in the ethyl sulfate is computed. It is shown that T_1 in the direct-process region should exhibit a large anisotropy with respect to the direction of the external magnetic field. The necessary Zeeman admixture of excited levels into the ground level is shown to be much smaller when the external field is parallel rather than perpendicular to the symmetry axis. This is because, on the one hand, the levels connected by a parallel field lie in the next J multiplet, some 1100 cm^{-1} away. On the other hand, a perpendicular field can connect the ground state with a level within the ground multiplet, only 53.6 cm^{-1} away. This is shown to be a general result for ions with small J values in crystals of moderately high symmetry. (auth)

21189 SPECIFIC HEAT OF SAMARIUM METAL BETWEEN 0.4 AND 4°K. O. V. Lounasmaa (Argonne National Lab., Ill.). Phys. Rev., 126: 1352-6(May 15, 1962).

In addition to the usual lattice and electronic terms, proportional to T^3 and T, respectively, the specific heat of most rare earth metals at low temperatures has two other contributions: a magnetic specific heat due to exchange interaction between the electronic spins, and a nuclear specific heat due to splitting of the nuclear energy levels in the strong magnetic field produced by the 4f electrons. Samarium metal is antiferromagnetic below 13.6°K and the magnetic specific heat, according to the spin wave theory, should be proportional to T^3. The nuclear specific heat has a T^{-2} temperature dependence in the first approximation; the next term in a series expansion proportional to T^{-4} was also included in the analysis. Thus, $C_p = AT^3 + BT + DT^{-2} - ET^{-4}$, where the first term represents both the lattice and magnetic specific heats. Values of the constants, as determined by the method of least squares from 71 experimental points between 0.4 and 2.5°K, are (for specific heat in millijoules/mole°K): A = 0.88 – 1.11; B = 12.1; D = 8.56; E = 0.021. The magnetic specific heat appears to depend on the time the sample spent in the vicinity of the antiferromagnetic Curie point when it was cooled down, hence the variations in the value of A. Constants B and D are probably accurate to 5% and 2%, respectively. The effective magnetic field at the nucleus, as calculated from the value of constant D, is 3.3×10^6 gauss. (auth)

21190 SPECIFIC HEAT OF DYSPROSIUM METAL BETWEEN 0.4 AND 4°K. O. V. Lounasmaa and R. A. Guenther (Argonne National Lab., Ill.). Phys. Rev., 126: 1357-63 (May 15, 1962).

The heat capacity of dysprosium has been measured between 0.4 and 4°K in a He^3 cryostat. In this temperature range the specific heat of the metal can be written $C_p = AT^3 + BT + CT^{1/2} + DT^{-2} - ET^{-3} - FT^{-4}$. The first term is the lattice specific heat, the second the electronic specific heat, the third the magnetic specific heat caused by exchange interaction between the electronic spins, and the remaining terms are the nuclear specific heat due to splitting of the nuclear energy levels by the strong magnetic field of the 4f electrons and by quadrupole coupling. An anomalous contribution to the heat capacity, probably due to the 0.08% oxygen impurity in the sample, was observed between 1.2 and 3.5°K. By excluding the measurements in this temperature region the following values were obtained for the constants in the above equation (for specific heat in millijoules/mole °K): B = 9.5 ± 10%, C = 9.7 ± 10%, D = 26.4 ± 2%. The result A = 0.22 by Dreyfus et al. was adopted and constants E = 1.32 and F = 0.12 were calculated from the available electron paramagnetic resonance data. Considerable disagreement exists in the temperature range from 2 to 4°K between measurements of the specific heat of dysprosium by different investigators. It is shown, however, that the discrepancies appear to be in the magnetic specific heat only, C varying between 0 and 24. The various values of B are all in good agreement. Our result for D is in excellent accord with the value 26.6 obtained from electron paramagnetic resonance experiments on dilute salts. The magnetic field at the dysprosium nucleus as calculated from the value of D after the effect of quadrupole coupling had been subtracted is 7.1×10^6 gauss, in good agreement with $H_{eff} = 7.3 \times 10^6$ gauss determined for Dy^{161} by Mössbauer techniques. (auth)

21191 FUSION CURVE AND POLYMORPHIC TRANSITIONS OF CESIUM AT HIGH PRESSURES. G. C. Kennedy, A. Jayaraman, and R. C. Newton (Univ. of California, Los Angeles). Phys. Rev., 126: 1363-6(May 15, 1962).

The fusion curve of cesium metal has been studied up to 50,000 atmospheres. The curve is unique among elements

studied, in that it shows two maxima, one at approximately 22.5 kbar and 197°C, and a second at approximately 30 kbar and 198°C. Two triple points have been located. At 195°C, cesium has four different melting-freezing points and possibly another one at still higher pressures. (auth)

21192 PARAMAGNETIC RESONANCE OF S-STATE IONS IN METALS. M. Peter, D. Shaltiel, J. H. Wernick, H. J. Williams, J. B. Mock, and R. C. Sherwood (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev., 126: 1395-1402(May 15, 1962).

The interaction between conduction electrons and paramagnetic ions in metals has been investigated by observation of the paramagnetic resonance of gadolinium in alloys and intermetallic compounds. Spectra of Gd in powdered samples were observed at temperatures between 1.4 and 500°K and frequencies between 10 and 80 kMc/sec. A single line has been observed with g values varying between 2.01 and 1.88. A striking correlation has been established between the g shifts and the susceptibility and the specific heat of the pure Rh–Pd and Pd–Ag alloys, leading to the conclusion that the shifts are due to the interaction of the host conduction electrons with the paramagnetic ions. Linewidth considerations indicate that this interaction is mostly of scalar form. From the observed dependence of the g shift and linewidth on the magnetization it is concluded that the interaction produces the electron Knight shift predicted by Yosida, rather than the shift predicted by Kittel and Mitchell. The observed negative shift indicates that there is a polarization of mostly negative sign in agreement with previous nuclear magnetic resonance observations on $GdAl_2$ by Jaccarino et al. A possible mechanism for this negative polarization is the Anderson-Clogston mechanism. Some experiments on line broadening due to different magnetic species, and their connection to the absence of the g shift of Gd and Mn in Ag are discussed briefly. (auth)

21193 PHOTOEQUILIBRIUM BETWEEN KCl F AND F′ CENTERS AT 80°K. A. Costikas and L. I. Grossweiner (Illinois Inst. of Tech., Chicago). Phys. Rev., 126: 1410-20 (May 15, 1962).

The illumination of F centers in KCl at 80°K establishes a photoequilibrium between F′ and F centers. The equilibrium transformations are reversible and are of the same magnitude for additively colored crystals and crystals x-rayed at 80°K and 300°K. The photostationary ratio of F′ to F centers varies with the logarithm of the incident light intensity. Transitions between equilibrium levels approximate first-order processes, controlled by the rate of light absorption in the F and F′ bands. A kinetic model is proposed in which the elementary steps are the photoionization of F and F′ centers, and electron capture at F centers and negative-ion vacancies. The variation of light intensity and spectrum through the crystal is accounted for by assuming that temporal equilibrium is maintained in local regions and integrating the results over the crystal volume. The photoionization quantum efficiency of the F center at 80°K is calculated to be 0.020 ± 0.003; this quantity is one-half of the photobleaching quantum efficiency. A value of 0.016 ± 0.005 is obtained for the ratio of the electron-capture cross section of the F center to the chloride-ion vacancy. (auth)

21194 ELECTRON-NUCLEAR DOUBLE RESONANCE STUDIES OF COLOR CENTERS. William T. Doyle (Dartmouth Coll., Hanover, N. H.). Phys. Rev., 126: 1421-6 (May 15, 1962).

The electron-nuclear double resonance (ENDOR) method is applied to the study of the interaction of F-center electrons with the first two nuclear shells in NaCl, KBr, and NaH. From the angular dependence of single-crystal ENDOR spectra, values are obtained for the isotropic magnetic interaction constants and the principal values of the magnetic and electric-quadrupole interaction tensors in NaCl and KBr. ENDOR powder spectra are obtained and analyzed to obtain isotropic and anisotropic contributions to the magnetic interaction in NaH. (auth)

21195 TREATMENT OF IONIZED IMPURITY SCATTERING IN DEGENERATE SEMICONDUCTORS. APPLICATION OF THE VARIATIONAL TECHNIQUE IN THE PARTIAL-WAVE METHOD. P. Csavinszky (General Dynamics/Electronics, Rochester, N. Y.). Phys. Rev., 126: 1436-40(May 15, 1962).

Using the partial-wave method, ionized impurity scattering in degenerate semiconductors is discussed. It is shown that the scattering process is adequately described by considering only the zeroth-order phase shift. By making use of Kohn's variational principle this quantity is determined analytically and an analytical formula is derived for the resistivity due to ionized impurity scattering alone. (auth)

21196 THERMAL CONDUCTIVITY OF SOLIDS. III. MODIFICATION OF THREE-PHONON PROCESSES BY ISOTOPIC SCATTERING. P. Carruthers (Cornell Univ., Ithaca, N. Y.). Phys. Rev., 126:1448-52(May 15, 1962).

The experimental observation that the effective strength of the phonon-phonon scattering in Ge–Si mixtures increases with the disorder parameter is explained qualitatively and semi-quantitatively by means of second-order interactions in which the three-phonon processes are modified by isotopic scattering. This effect is large because of the occurrence of small-energy denominators and the increased number of final states resulting from the over-all nonconservation of crystal momentum for such three-phonon processes. (auth)

21197 RANGE OF EXCITED ELECTRONS IN METALS. John J. Quinn (RCA Labs., Princeton, N. J.). Phys. Rev., 126: 1453-7(May 15, 1962).

The energy of interaction of a single excited electron with the sea of conduction electrons in a metal has been calculated by a self-energy approach. The imaginary part of the self-energy of the excited electron can be interpreted in terms of a total rate of real collisions with the sea of conduction electrons. By weighting the differential scattering rate by the amount of energy lost in each scattering event, one obtains an expression for the instantaneous rate of energy loss of the excited electron as a function of its initial energy. The extremely strong dependence of this rate on the initial energy is the main result of this paper. For slow electrons, by which is meant those of initial energy smaller than the sum of the Fermi energy and the plasma energy of the electron gas, the rate of energy loss is determined by the small imaginary part of the dielectric constant. For electrons close to the Fermi surface this rate is proportional to $(p - p_0)^3$, where p is the momentum of the excited electron and p_0 the Fermi momentum; therefore in this range the rate of energy loss is very sensitive to the initial energy. For fast electrons, a new contribution to the rate of energy loss arises due to a pole of the inverse dielectric constant. This new process corresponds to the excitation of plasma oscillations by the excited electron, and causes fast electrons to lose energy very rapidly. (auth)

21198 CORRELATION FUNCTION CALCULATION OF THERMAL CONDUCTIVITY. William C. Schieve (Naval Radiological Defense Lab., San Francisco) and Robert L. Peterson. Phys. Rev., 126: 1458-60(May 15, 1962).

Recent theories of transport in fluids express the therm

conductivity in terms of correlation functions of the thermal flux. It is shown that such an expression for the thermal conductivity reduces to that conventionally obtained by use of the Boltzmann transport equation for phonon scattering in crystals, if the rate of change of phonon occupation numbers due to scattering may be characterized by a relaxation time per mode of vibration. The elastic scattering of phonons by randomly arranged scatterers in anisotropic crystals is also discussed. It is shown that a new relaxation mechanism can, in certain cases, simply characterize the thermal conductivity. (auth)

21199 1 ^{1}S, 2 ^{1}S, AND 2 ^{3}S STATES OF H^- AND OF He. C. L. Pekeris (Weizmann Inst., Rehovoth, Israel). Phys. Rev., 126: 1470-6(May 15, 1962).

The ionization energy J, including mass-polarization and relativistic corrections but not the Lamb shift correction, was evaluated for the 1 ^{1}S state of the negative-hydrogen ion using determinants up to order n = 444. J(444) = 6083.0943 cm^{-1}, and, by extrapolation, J(∞) = 6083.0958 cm^{-1}. A search for bound states 2 ^{1}S and 2 ^{3}S of H^- led to negative results. In the case of helium, an upper bound to the nonrelativistic energy eigenvalue ν for the 1 ^{1}S state was evaluated at n = 1078 to be ν_+ = 198317.866 cm^{-1}, as against the previously determined lower bound of $\nu_-(1078)$ = 198317.374 cm^{-1}. For the 2 ^{3}S state this gap is already completely closed at n = 715, with $\nu_+(715)$ = 38453.1299 cm^{-1} and $\nu_-(715)$ = 38453.1292 cm^{-1}. At n = 1078, J = 38454.827375 cm^{-1}, and the electron charge density at the nucleus D(0) comes out 33.18414092, in agreement with previously extrapolated values. This substantiates a disagreement of the order of one part in 10^5 between theory and experiment in the hyperfine structure of the 2 ^{3}S state of He^3 which was established by White, Chow, Drake, and Hughes. With Suh and Zaidi's value for the Lamb shift of -0.109 ± 0.009 cm^{-1}, the ionization energy of the 2 ^{3}S state comes out 38454.718 ± 0.009 cm^{-1}, as against Herzberg's experimental value of 38454.73 ± 0.05 cm^{-1}. For the 2 ^{1}S state J(615) = 32033.318 cm^{-1}, which with a Lamb shift of -0.104 ± 0.014 cm^{-1} evaluated by Suh and Zaidi, leads to an ionization energy of 32033.214 ± 0.014 cm^{-1}. The experimental value is, according to Herzberg, equal to 32033.26 ± 0.03 cm^{-1} or, at worst, ± 0.05 cm^{-1}. A summary is given of the verification to date of the Lamb shift in two-electron atoms. (auth)

21200 ELECTRON CAPTURE FROM ATOMIC HYDROGEN BY PROTONS. Robert A. Mapleton (Air Force Cambridge Research Labs., Bedford, Mass.). Phys. Rev., 126: 1477-80(May 15, 1962).

In a paper by Bates and Dalgarno the BK (Brinkman-Kramers) cross sections together with the ground-state cross section of Jackson and Schiff were used to estimate the Born cross sections for capture into excited states of the hydrogen atom. In the present paper the Born cross sections are calculated numerically for capture into seven different final states. These results show that the estimates of Bates and Dalgarno are very good. In addition, the Born and BK cross sections for capture from He($1s^2$) are compared with the corresponding quantities for capture from atomic hydrogen. The similarity of certain cross-section ratios for these two atoms suggests the possible use of these ratios to estimate the Born capture cross sections for other atoms from the BK cross sections for the corresponding atoms. (auth)

21201 ENHANCEMENT OF ELECTRON DENSITY AROUND POSITIVE POINT CHARGES IN METALS AND LIFETIMES OF POSITRONS. N. H. March and A. M. Murray (The University, Sheffield, Eng.). Phys. Rev., 126: 1480-1(May 15, 1962).

By means of approximate self-consistent field calculations using a model of a finite metal with ~2000 electrons, it is shown that over the range of densities appropriate to metals under normal conditions, the density at the position of a single positive charge varies by a factor of about 2, whereas the variation in the mean electron density ($3/4\pi r_s^3$) is an order of magnitude greater. In a simple Hartree calculation of the type reported, a bound state occurs when $r_s > 4$ atomic units. Some brief remarks are made on the application of these results to the calculation of the lifetimes of positrons in various metals. (auth)

21202 ELECTRON PHOTODETACHMENT FROM IONS AND ELASTIC COLLISION CROSS SECTIONS FOR O, C, Cl, AND F. John W. Cooper and Jerry B. Martin (National Bureau of Standards, Washington, D. C.). Phys. Rev., 126: 1482-8(May 15, 1962).

Photodetachment cross sections for O^-, C^-, Cl^-, and F^- have been computed in the energy range from threshold to 50 ev by the Klein-Brueckner method. Elastic cross sections for electron scattering from O, C, Cl, and F in the energy range 0 to 15 ev have also been computed. The method of calculation is described and the results compared with earlier theoretical and experimental work. (auth)

21203 NUCLEAR MAGNETIC RESONANCE OF Lu^{175}. A. H. Reddoch and G. J. Ritter (National Research Council, Ottawa). Phys. Rev., 126: 1493-5(May 15, 1962).

The nuclear magnetic resonance of Lu^{175} has been discovered in LuB_{12} and LuSb. The lutetium-to-deuteron frequency ratios were found to be 0.73677 ± 0.00002 and 0.73732 ± 0.00002 in the respective compounds. The nuclear magnetic moment of Lu^{175} derived from these measurements is 2.230 ± 0.011 nm. (auth)

21204 ON THE THEORY OF THE CRYSTAL. I. P. Bazarov (Moscow State Univ.). Physica, 28: 479-84(May 1962). (In English)

A proposal is presented for an exactly soluble model of a crystal, which is founded on the main property of the crystalline state, namely its periodic structure. (auth)

21205 SPONTANEOUS EMISSION OF PHONONS AND SPECTRAL LINE WIDTHS OF SOME RARE EARTH IONS IN CRYSTALS. S. Yatsiv (Univ. of Jerusalem). Physica, 28: 521-9(May 1962). (In English)

A correlation is found between the line widths in the spectra of rare-earth ions in crystals and relaxation processes between closely spaced Stark levels. It is inferred from relaxation times between magnetic sublevels that the transition probabilities between neighboring Stark levels are often as high as 10^{10} sec^{-1}. The resulting reduction in the lifetime of such levels is sufficient to broaden optical transitions. It also follows that upon continuous excitation at low temperatures, a population inversion is maintained in a large number of energy intervals of these ions. (auth)

21206 STRUCTURE OF SHOCK WAVES IN MAGNETOHYDRODYNAMICS WITH ARBITRARY DISSIPATION LAW. A. G. Kulikovskii. Priklad. Mat. i Mekhan., 26: 273-9 (Mar.-Apr. 1962). (In Russian)

A one-dimensional stationary flow of viscous heat conducting gas with finite electric conductivity is examined with the assumption that the flow is expressed by a structure of fast and slow, average amplitude shock waves. Dissipative processes were described by the Onzager principle, and the rate of entropy change, d_iS/dt, was considered to be positive when the spatial derivative of one

of the flux determining parameters differed from zero. The analysis is based on published data on quasi-linear equation systems with two and three unknown functions and on the solution of wave propagation equations. (R.V.J.)

21207 WAVE SOLUTIONS IN GENERAL RELATIVITY. [PART] I. I. M. Pandya and P. C. Vaidya (Gujarat Univ., Ahmedabad, India). Proc. Natl. Inst. Sci. India. Pt. A, 27: 620-4(Nov. 26, 1961). (In English)

Wave solutions with axial symmetry describing the flow of gravitational and electromagnetic waves are considered in the scheme of general relativity. The coordinates are chosen such that the wave pattern is given by the 3-surface t = constant. This introduces simplification in the line element, as also in the components of the electromagnetic field tensor. The solutions divide themselves into two distinct types: solutions with open wave surfaces and solutions with closed wave surfaces. The first case is worked out fully and it is found that these solutions describe the flow of gravitational and electromagnetic radiations in the same wave pattern. (auth)

21208 KINEMATIC BRANCH POINTS OF n-PARTICLE REACTION AMPLITUDES. Hong-Mo Chan (Univ. of Hong Kong). Proc. Roy. Soc. (London), A265; 351-64(May 22, 1962).

The branch points of scattering amplitudes at the thresholds of production of two-particle states have a kinematic origin. The formulation of the scattering problem involves a momentum variable k that implies that the amplitude, when considered as a function of the energy E, must in general have a square-root branch point at threshold, i.e., at k = 0. The discussion is extended to similar kinematic branch points of the general n-line graph. Beside the 'threshold' branch points for multiple production, another class of kinematic branch points is discovered, the existence of which is a result of the necessary linear dependence of any five vectors in the Lorentz space. These new branch points exist only for graphs with six lines or more. Generalized momentum variables (l-variables) are introduced, which allow a determination of the position of both these types of kinematic branch points in the many-dimensional complex space by simple algebraic computations. The kinematic origin of these branch points, as exemplified by this method of treatment, also gives some indications to the intrinsic nature of the branch points and to the basic structure of the many-dimensional Riemann "surface." (auth)

21209 THE VISCOSITY AND THERMAL CONDUCTIVITY OF ATOMIC HYDROGEN. A. Dalgarno and F. J. Smith (Queen's Univ., Belfast). Proc. Roy. Soc. (London), A267: 417-23(May 22, 1962).

The viscosity and thermal conductivity of atomic hydrogen are calculated on the classical scattering theory for temperatures up to 10^5°K. A comparison with quantal calculations suggests that classical theory is adequate for temperatures above 100°K. (auth)

21210 SHOCK FRONTS IN TWO-DIMENSIONAL FLOW. L. A. Elliott (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). Proc. Roy. Soc. (London), A267: 558-65(June 5, 1962).

A numerical method of treating shock waves in two-dimensional unsteady hydrodynamic flow is considered. The shock is regarded as a discontinuity in the flow and its motion is determined by a characteristic method from conditions inside its domain of dependence. As an illustration of the method, numerical solutions are obtained for the dynamics of the motion caused by detonating a sphere of explosive over a cap. (auth)

21211 THE BOLTZMANN EQUATION FOR ANISOTROPIC METALS. E. H. Sondheimer (Univ. of London). Proc. Roy. Soc. (London), A268: 100-8(June 19, 1962).

It is pointed out that the Boltzmann equation in the theory of metals reduces to a finite set of linear algebraic equations whenever the scattering probability can be written as a finite sum of the form $\Sigma p_i(k)q_i(k')$. The explicit form of the solution, valid for arbitrary energy surfaces, is derived for this model. (auth)

21212 CORRECTION FOR SELF-INTERACTION IN THE THOMAS-FERMI POTENTIAL WITH APPLICATION TO f ELECTRONS IN ATOMS. C. A. Coulson and C. S. Sharma (Oxford Univ.). Proc. Phys. Soc. (London), 79: 920-9(May 1, 1962).

A formula is developed that corrects for self-interaction in the Thomas–Fermi statistical theory of the atom. By means of this formula, it is possible to write an effective Schroedinger equation for any separate orbital. This equation is solved for the 4f and 5f series of atoms. The results show the expected sudden contractions in mean radius at about Z = 61 and 91. A discussion is given showing the difficulty in making adequate allowance for exchange in a one-electron scheme of this kind. (auth)

21213 THE MAGNETIC STRUCTURE OF AuMn. G. E. Bacon (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Proc. Phys. Soc. (London), 79: 938-45 (May 1, 1962).

A neutron-diffraction study of polycrystalline samples of gold–manganese alloys near the composition AuMn correlates the crystallographic and magnetic-structure changes as the composition and temperature are varied. The interlayer spacing between the antiferromagnetically arranged ferromagnetic sheets is retained practically unaltered. It is concluded that the magnetic moment on the manganese atoms is 4.2 Bohr magnetons. (auth)

21214 THE MAGNETOSTRICTION OF DYSPROSIUM METAL. E. W. Lee and L. Alberts (Univ. of Sheffield, Eng.). Proc. Phys. Soc. (London), 79: 977-80(May 1, 1962).

The magnetostriction of dysprosium metal is measured at 20.3°K and from 90 to 206°K. At the lowest temperature, at which the metal is ferromagnetic, the magnetostriction constant λ_s is found by extrapolation to be 3.4×10^{-3}. The magnetostrictive behavior of dysprosium in the antiferromagnetic region can be qualitatively accounted for in terms of the deformation of a helical spin system. (auth)

21215 THE DIAMAGNETIC SHIELDING OF NUCLEI BY CONDUCTION ELECTRONS IN METALS. M. J. Stephen (Mathematics Inst., Oxford). Proc. Phys. Soc. (London), 79: 987-93(May 1, 1962).

The diamagnetic shielding of nuclei by Bloch electrons in a metal is considered. The shielding may be divided into a Lorentz correction arising from a uniform magnetization, and a part caused by the induced volume currents. An exact expression in the Bloch model is derived for the volume current density induced in a metal by a uniform magnetic field. This expression permits in principle the calculation of the shielding. Certain special cases are discussed. (auth)

21216 CHARGED BOLTZMANN GAS AT ABSOLUTE ZERO. M. J. Stephen (Mathematics Inst., Oxford). Proc. Phys. Soc. (London), 79: 994-1000(May 1, 1962).

The correlation energy of a charged Boltzmann gas at absolute zero is calculated. The result is exact at high density. Investigation of the magnetic properties reveals that this system exhibits a Meissner effect of the London type. At any finite temperature the system is diamagnetic.

Consideration of the effect of the Coulomb interaction on the Meissner effect leads to the conjecture that the London constant is independent of the particle interactions. The results are also applicable to a charged boson gas at absolute zero. (auth)

21217 PERTURBATIONS IN AN ELECTRON GAS AT NON-ZERO TEMPERATURES. N. H. March and A. M. Murray (Univ. of Sheffield, Eng.). Proc. Phys. Soc. (London), 79: 1001-10(May 1, 1962).

Assuming electrons to move in a common perturbing potential, which is to be determined self-consistently, a general theory is given for the evaluation of charge and potential distributions around perturbations in an originally uniform electron gas at elevated temperatures. In the nondegenerate case, and to first order in the perturbing potential, the results lead to a theory of ionized impurity centers in semiconductors. The low-temperature problem in a high-density gas is also considered, and results are presented that indicate how the long-range density oscillations around a perturbation are damped out by the temperature effect in this case. Conclusions about the effect of electron interactions on the long-range oscillations are suggested. Finally it is pointed out that, when slowly varying potential assumption is valid, the perturbation series may be summed. (auth)

21218 IONIZATION OF ATOMS BY PROTONS. A. R. Lee and J. B. Hasted (University Coll., London). Proc. Phys. Soc. (London), 79: 1049-57(May 1, 1962).

A classical impenetrable-sphere treatment of the collision of a proton and a single orbital electron is found to lead to limiting proton impact energies E_p between which the ionization cross section function reaches its maximum value, viz. $1.46E_i \leq (m/M)E_p \leq 2.25E_i$, with ionization potential E_i and proton and electron masses respectively M and m. This result is consistent with experimental data. From the experimental emitted electron energy distributions the classical treatment yields electron angular distribution functions, which are computed at representative electron energies. (auth)

21219 FURTHER PROPERTIES OF CERTAIN CLASSES OF TRANSFER FUNCTIONS. [PART] II. A. H. Zemanian (New York Univ., N. Y.). Quart. Appl. Math., 19: 158-9(July 1961).

Consequences of previously published results which are immediately applicable to rational transfer functions that have no poles in the right-half plane and have at least twice as many poles as zeroes are pointed out. (M.C.G.)

21220 THE THEORY OF THE NUCLEAR MOLECULE CONSISTING OF TWO C_6^{12} NUCLEI. P. Gombás and D. Kisdi (Univ. of Technical Sciences, Budapest and Research Group for Theoretical Physics, Hungarian Academy of Sciences, Budapest). Z. Physik, 167: 250-7(1962). (In German)

With the aid of a variational method it is shown that on the basis of the energy expression of Skyrme the "nuclear molecule" consisting of two C_6^{12} nuclei has a stable state of equilibrium, which is in agreement with recent experimental results. The energy levels of the nuclear molecule were calculated and above 13 Mev no energy level was found, which is in qualitative agreement with the resonance structure of the empirical cross sections. (auth)

21221 SOLID STATE PHYSICS. ADVANCES IN RESEARCH AND APPLICATIONS. VOLUME 13. Frederick Seitz and David Turnbull, eds. New York, Academic Press, 1962. 493p. $14.50.

Vibrational transitions and spectra in solids are reviewed. Studies are reported of the high-temperature high-pressure behavior of solids; the mechanisms and theory of dislocations in LiF crystals; and electron spin resonance investigations of impurities and imperfections in semiconductors. Formalisms and representations encountered in band theory are reviewed. The implications, with respect to the nature of chemical bonding, of the properties of visible and ultraviolet absorption spectra are examined. (T.F.H.)

21222 SOLID STATE PHYSICS. ADVANCES IN RESEARCH AND APPLICATIONS. VOLUME 11. Frederick Seitz and David Turnbull, eds. New York, Academic Press, 1960. 449p. $12.50.

The preparation and physical and semiconducting properties of gray tin are reviewed. Photoelectronic studies of the ionization energies of imperfections in CdS-type materials are surveyed. The effects of elastic deformation on the electric properties of semiconductors are investigated. Techniques and applications of high-pressure physical measurements are examined. Cyclotron resonance of free charged particles and of carriers in solids is reviewed, and attention is given as well to cyclotron-resonance generation, amplification, and cross-modulation; millimeter and magnetoacoustic cyclotron resonance; and cyclotron resonance in strained Si and Ge. A cumulative topical index for volumes 1 through 10 is included. (T.F.H.)

21223 PROBLEMS IN QUANTUM THEORY OF MANY-PARTICLE SYSTEMS. A Lecture Note and Reprint Volume. L. Van Hove, N. M. Hugenoholtz, and L. P. Howland. Frontiers in Physics. A Lecture Note and Reprint Series. New York, W. A. Benjamin Inc., 1961. 65p.

Lecture notes are presented covering the interactions of elastic waves in solids. Reprints are also included concerning such subjects as space and time correlations, energy corrections, perturbation theory, and the Fermi-gas model; crystals and other interacting systems are considered. Neutron scattering is examined in several of the articles. (T.F.H.)

21224 AERODYNAMIC CAPTURE OF PARTICLES. Proceedings of a Conference held at B.C.U.R.A., Leatherhead, Surrey, 1960. E. G. Richardson, ed. Oxford, London, New York, and Paris, Pergamon Press, 1960. 203p. $8.00.

Fifteen papers are given which treat various topics on the theory and application of particle deposition phenomena and on particle capture by raindrops. One paper deals with deposition of radioactive particles, while others deal with dust deposition from turbulent airstreams, froth flotation, smoke particles, collision, etc. Three panel discussions are included. (D.L.C.)

21225 TABLITSY RASPREDELENIYA ENERGII I FOTONOV V SPEKTRE RAVNOVESNONO IZLUCHENIYA. (Distribution Tables of Energy and Photons in Equilibrium Emission Spectrum). P. A. Apanasevich and V. S. Aizenshtadt. Minsk, Publishing House of the Academy of Sciences, Belorussian SSR, 1961. 252p.

Tables are given for practical application in calculating photon energy distribution in equilibrium emission spectra. The main tables include the energy density of equilibrium emission $u(\nu,T)$ (Plank's functions) as functions of frequency and temperature. The tables cover the temperature range from 25 to 10^7°K. The cm^{-1} unit of frequencies is used up to 50,000°K and electrovolts are used at higher temperatures. Tables and nomographs are included of the energy distribution and of the number of emission photons according to their finite spectral intervals (from 0 to ν). A detailed description and instructions are given for each table. The tables were calculated with an electron memory device and do not exceed an order of error of 0.5 in the last term. (R.V.J.)

Astrophysics and Cosmology

Refer also to abstracts 20233 and 20234.

21226 (UCRL-Trans-804(L)) ABOUT THE FREQUENCY OF CHEMICAL ELEMENTS. G. Bussetti. Translated for Univ. of California Lawrence Radiation Lab., Berkeley from Nuovo cimento (9), 12: 769-79(1954). 17p.

The formulas of statistical thermodynamics, obtained by taking into account the relativistic energy of particles and the generation of pairs, are applied to the analysis of the distribution in the universe of the chemical elements assuming the hypothesis that the elements were created in conditions sufficiently near to those of thermodynamic equilibrium, so as to justify the approximate validity of such formulas. Starting with attempts to explain with the thermodynamic theory the experimental distribution of elements, it is found that an agreement with the observed data can be obtained only for densities $\rho \geq 10^{13}$ g/cm^3; furthermore, an upper limit for the total mass: $m \leq 10^{33}$ g, is obtained this latter in good agreement with astrophysical data concerning stellar masses. (auth)

21227 UPPER ATMOSPHERE TEMPERATURES DERIVED FROM CHARGED PARTICLE OBSERVATIONS. S. J. Bauer and R. E. Bourdeau (Goddard Space Flight Center, Greenbelt, Md.). J. Atmospheric Sci., 19: 218-25(May 1962).

Charged-particle temperature results obtained by rocket and satellite-borne Langmuir probes, rocket measurements of the altitude dependence of charged particle densities above the F2 peak, and radar incoherent backscatter are compared with models of kinetic gas temperature. From charged-particle data for conditions of a quiet sun at temperate latitudes, the comparison favors the concept of temperature equilibrium between electrons and heavy constituents in all but the lower F region of the ionosphere. Additional departures from equilibrium are indicated for disturbed ionospheric conditions and possibly for a quiet sun at auroral latitudes. (auth)

21228 NEUTRON LEAKAGE FLUX AND THE NITROGEN ABUNDANCE OF VENUS. R. E. Lingenfelter (Univ. of California, Los Angeles), W. N. Hess, and E. H. Canfield. J. Atmospheric Sci., 19: 274-8(May 1962).

Multigroup diffusion calculations of the equilibrium flux were performed for assumed atmospheric compositions; neutron leakage spectra are presented. An experiment for determining the nitrogen abundance of the Venusian upper atmosphere from neutron flux measurements is suggested. (L.N.N.)

21229 CAUSE OF THE PRELIMINARY REVERSE IMPULSE OF STORMS. E. H. Vestine and J. W. Kern (RAND Corp., Santa Monica, Calif.). J. Geophys. Research, 67: 2181-8(June 1962).

Atmospheric-current functions obtained for sudden commencements are analyzed. Electric-charge distributions in the ionosphere are deduced that could drive the part of the currents asymmetric about the geomagnetic axis. It is supposed, as an approximation, that only the Hall electric conductivity need be taken into account. Distortions of the outer magnetosphere that may give rise to the reverse impulse are discussed. (auth)

21230 RISE TIMES VERSUS MAGNITUDES OF SUDDEN COMMENCEMENTS OF GEOMAGNETIC STORMS. P. R. Pisharoty and B. J. Shrivastava (Colaba Observatory, Bombay). J. Geophys. Research, 67: 2189-92(June 1962).

A study of the rise times versus the magnitudes of the positive sudden commencements (SC's) of 41 randomly selected geomagnetic storms recorded at Alibag (geomagnetic coordinates $\Phi = 9.5°$, $\Lambda = 143.6°$) for the period 1949 to 1960 is presented. The study shows rise times of 1 to 6 minutes and shows that the rise times have an inverse relationship with the magnitudes of the SC's—the rise time being smaller as the magnitude is larger, and vice versa. The theory of the SC predicts rise times of less than about two minutes with an inverse relationship between rise time and amplitude. On the other hand, numerical computations from a hydromagnetic model show this inverse relationship and allow rise times of the order of 1 to 6 minutes, which appear to fit well the data of Alibag. (auth)

21231 THEORY OF GENERATION OF EXOSPHERIC VERY-LOW-FREQUENCY NOISE (HISS). R. L. Dowden (Univ. of Tasmania, Australia). J. Geophys. Research, 67: 2223-30(June 1962).

The traveling-wave-tube amplification process is considered. Account is taken of the spiral motion of particles traveling in the magnetic field, the interaction distance for which amplification at any one frequency can occur, and the slowing down of the stream particles by the wave amplification process. It is shown that narrow band bursts of hiss can be generated by weak electron streams of even very broad velocity and pitch distribution. The center frequency of such a band is characteristic of the terminating latitude of the line of force of generation. Stronger streams produce an overload effect giving rise to wide and very wide bands. Narrow bands can be produced at other frequencies by streams of narrow velocity and pitch distribution. (auth)

21232 X-RAY AND LYMAN-ALPHA EMISSION FROM THE SUN AS MEASURED FROM THE NRL SR-1 SATELLITE. R. W. Kreplin, T. A. Chubb, and H. Friedman (Naval Research Lab., Washington, D. C.). J. Geophys. Research, 67: 2231-53(June 1962).

Measurements made from the SR-1 satellite confirm the hypothesis that solar x rays are the cause of flare SID events, and that variations in solar Lyman α emission are not geophysically significant. Results also indicate that active prominence regions, bright surges on the limb, and certain limb flares have the same x-ray characteristics as major disk flares. SID phenomena occur when the solar x-ray flux below 8 Å exceeds 2×10^{-3} erg cm^{-2} sec^{-1} as measured above the earth's atmosphere. Solar x-ray fluxes can change significantly in a time scale of the order of 1 minute. Long-duration x-ray events of moderate intensity can accompany rising limb prominences. (auth)

21233 IONOSPHERIC DISTURBANCES ASSOCIATED WITH THE SOLAR FLARE OF SEPTEMBER 28, 1961. D. P. Kanellakos and O. G. Villard, Jr. (Stanford Univ., Calif.). J. Geophys. Research, 67: 2265-77(June 1962).

Changes produced in the phase, frequency, and amplitude of stable HF waves during the solar flare of September 28, 1961, and the geomagnetic sudden commencement (SC) of September 30, 1961, were analyzed. The HF waves, of approximately 15 and 18 Mc, were transmitted over east-west paths 2420 and 5640 km long. Over the longer path, the phases of both signals were advanced by 1400 and 1200 cycles, respectively, whereas their respective frequencies were increased by 8.4 and 7 cps. Absorption commenced after the major portions of the phase and frequency changes had taken place. Over the shorter path, the frequencies of the 15- and 18-Mc signals were increased by 2.4 and 1.4 cps respectively. During the SC the frequency of the 18-Mc signal transmitted over the short path first increased by 1 cps and then decreased by 2.2 cps. Following the sud-

dam frequency shift, the instantaneous received frequency oscillated with a period of about 30 sec. Since absorption commenced after the main frequency and phase advance, and since it disappeared before the phase recovery, it was suggested that the changes in the electron density were produced by UV radiation energy in the 140- to 200-km region. This hypothesis was strengthened by the circumstance that the maximum phase changes were—approximately—inversely proportional to the operating frequency. The appearance of solar x rays (>20 kev) coincided with the onset of absorption of the signals and the onset of a second phase of peak activity in the phase and amplitude scintillation frequency of the signals. The ionization production, as obtained from the rate of change of the phase of the incoming HF signals, did not correspond exactly with the time history of the solar x rays in the >20-kev energy. Softer x rays had to be responsible for the electron production that caused the phase changes. (auth)

21234 COSMIC MAGNETIC FIELDS. J. H. Piddington (Commonwealth Scientific and Industrial Research Organization, Radiophysics Lab., Sydney). Nature, 194: 962-3 (June 9, 1962).

The origin of magnetic fields in space is one of the outstanding problems in astrophysics. The possible origin from neutron creation, alignment in the intergalactic field, and decay is suggested. It is shown that only a small proportion of the neutron decay energy is needed to create the field. The aligned-neutron hypothesis is compared with the possible creation of magnetic fields by cosmic radio sources, and a laboratory experiment on aligned radioactive ions is suggested. (D.L.C.)

21235 STAR FORMATION IN ELLIPTICAL GALAXIES AND INTENSE RADIO SOURCES. A. G. W. Cameron (National Aeronautics and Space Administration, New York). Nature, 194: 963-4(June 9, 1962).

G. R. Burbidge's suggestion that the intense radio emission from giant elliptical galaxies may be due to supernova chain explosions is reviewed. The process of star formation in a giant elliptical galaxy is considered with a view to explaining intense supernova activity in some other way. It is concluded that star formation and rapid evolution will lead to a period of intense supernova activity and hence to the formation of a strong radio source, and that visible synchrotron radiation will be produced. A reply from Burbidge is included in which the hypothesis of rapid star formation and evolution is criticized, particularly the neglect of the turbulent velocity in the calculation of the critical mass for gravitational instability. (D.L.C.)

21236 LEE-YANG VECTOR FIELD AND ISOTROPY OF THE UNIVERSE. R. H. Dicke (Princeton Univ., N. J.). Phys. Rev., 126: 1580-1(May 15, 1962). (PUC-1961-55)

Lee and Yang suggested that, associated with heavy-particle conservation, there may exist an analog of the electromagnetic field, a field for which nucleons and antinucleons would serve as positive and negative "charges." It is shown that the null result from a recent repetition of the Eötvös experiment implies that, if it exists, the Lee-Yang interaction is at most only 10^{-7} of the gravitational interaction. This great weakness does not imply that the field does not exist. However, with the assumption of the isotropy of the average matter distribution of the universe, the Lee-Yang antisymmetric field tensor vanishes when averaged over sufficiently large volumes. This implies that, if the Lee-Yang field exists, nucleons and antinucleons are present in equal numbers in the universe, presumably gathered in matter and antimatter galaxies. However, it is found that the fact that a copious stream of γ rays is not present in the cosmic rays can be used to exclude such numbers of antimatter galaxies. It is concluded that the Lee-Yang field probably does not exist. (auth)

21237 COSMOLOGICAL CONSIDERATIONS OF THE ABSORBER THEORY OF RADIATION. J. E. Hogarth (Queen's Univ., Kingston, Ont.). Proc. Roy. Soc. (London), A267: 365-83(May 22, 1962).

The hypotheses that the physically significant solutions of Maxwell's equations are those which exhibit perfect time-symmetry, and that radiation is not an intrinsic property of charge, are examined. It is concluded that radiation and the electrodynamical arrow-of-time may be dependent upon the large-scale cosmological properties of the universe. (auth)

Cosmic Radiation

Refer also to abstracts 20231, 20232, 20235, 20245, and 20246.

21238 (NP-11658) SOLAR FLARE X-RAY BURST ON SEPTEMBER 28, 1961. K. A. Anderson and J. R. Winckler (California. Univ., Berkeley). 41p.

The solar flare of 28 September 1961 was exceptionally intense in its production of Hα light; it also emitted a burst of x rays observed by high-altitude, balloon-borne detectors. The burst had a small precursor, a very rapid rise, and a three component decay. The main part of the burst is therefore interpreted as being made up of three separate pulses. The x-ray burst shows microwave bursts at the highest radio frequencies which coincide precisely in time with the precursor and the main peak, and groups of type III bursts occur at or near the time of discontinuities in the decay of the x-ray burst and thus are associated with the leading edges of the three energetic electron pulses whose bremsstrahlung constitutes the observed x-ray flux. The appearance of both type III radiation originating in the corona at about 10^5 km and bremsstrahlung x rays which cannot reasonably be produced above roughly 5000 km height in the chromosphere gives strong evidence that energetic electrons undergo large scale motions in the solar atmosphere during chromospheric flares. In the case of this particular flare a filamentary structure appears to be rooted near the sunspot where the flare occurs. Although no direct observations exist on this point, the filament no doubt extends up into the lower corona perhaps to heights of 10^5 km. This leads to the possibility that the electrons are contained and guided by this structure. A detailed analysis of the spectral time variation shows that the solar electrons must spend most of their time above the 10,000 km level. (auth)

21239 SOLAR PROTONS, ALPHA PARTICLES, AND HEAVY NUCLEI IN NOVEMBER 1960. E. P. Ney and W. A. Stein (Univ. of Minnesota, Minneapolis). J. Geophys. Research, 67: 2087-2105(June 1962).

Energy spectra of solar protons and α particles were measured in the event following the November 12, 1960, flare. The ratio of the abundance of protons to the abundance of α particles above any given rigidity was found to be 2. Spectra of protons, α particles, and medium nuclei were measured after the November 15, 1960, flare. The proton spectrum showed that the magnetic cutoff existing at Minneapolis until approximately 10 hours after the flare had a value of about 0.7 Bv but was not sharp. The ratio of the abundance of the various nucleonic components above the same rigidity was found to be $p:\alpha:CNO = 100:100:1$. The abundance of electrons of rigidity greater than 0.7 Bv was found to be less than 2 per cent of the abundance of

protons. A model was suggested by which it would be expected that the ratios of protons to α particles and protons to medium nuclei would change considerably between solar events, but the ratio of α particles to medium nuclei would remain constant. (auth)

21240 CLOUD-CHAMBER OBSERVATIONS OF SOLAR COSMIC RAYS OVER MINNEAPOLIS ON SEPTEMBER 4, 1960. James A. Earl (Univ. of Minnesota, Minneapolis). J. Geophys. Research, 67: 2107-17 (June 1962).

The energy spectrum of solar cosmic rays was measured as a function of time during a period of changing geomagnetic cutoff rigidities. A "quasi-sharp" cutoff was present at all times, but the value of the cutoff rigidity changed markedly during the 6-hour flight period. No solar cosmic-ray electrons were observed; the upper limit on the ratio of solar electron flux to solar proton flux for particles with momentum >450 Mev/c was 0.25 per cent. The differential energy spectrum of solar protons in the energy range from 160 to 500 Mev was found to be $dN/dE = 4.1 \times 10^{19} E^{-4}$ meters/Mev for the period 2000 to 2320 UT on September 4, 1960. This spectrum was believed to be essentially the same as that of solar protons in space. (auth)

21241 CERENKOV SCINTILLATION COUNTER MEASUREMENTS OF THE LIGHT, MEDIUM, AND HEAVY NUCLEI IN THE PRIMARY COSMIC RADIATION FROM SUNSPOT MINIMUM TO SUNSPOT MAXIMUM. F. B. McDonald (Goddard Space Flight Center, Greenbelt, Md.) and W. R. Webber. J. Geophys. Research, 67: 2119-32 (June 1962).

The intensity and rigidity spectra of Be, B, C, N, and O were measured on a series of three balloon flights using a Cerenkov scintillation detector combination. The flights occurred at times close to solar minimum and maximum. The energy and charge resolution was comparable to that obtained by emulsion techniques. It was observed that the light and medium nuclei displayed the same relative rigidity spectra throughout the solar cycle as the protons and α particles. This conclusion was valid only in the region studied ($E > 400$ Mev/nucleon), and striking variations might well be expected for heavy primaries of low energy. The measured ratio of light to medium nuclei at the top of the atmosphere was 0.36 ± 0.06; it was not observed to vary appreciably over the solar cycle. (auth)

21242 THE LOW-FREQUENCY POWER SPECTRUM OF COSMIC-RAY VARIATIONS DURING IGY. David Stern (Goddard Space Flight Center, Greenbelt, Md.). J. Geophys. Research, 67: 2133-44 (June 1962).

The power spectrum of cosmic-ray variations, as recorded by neutron monitors at various locations, is computed and analyzed. The frequency range covered, from 1/200 to 1/2 $(day)^{-1}$, is found to contain only one significant peak, contributed by the 27-day variation. Using the power spectrum, a quantitative estimate of the latitude dependence of the 27-day variation may be made. From this, the average rigidity dependence of the modulation amplitude is deduced and is found to be essentially the same as that of Forbush decreases. The averaging is over the period July 1957 to December 1958, during which the peak decreases significantly. Irregular variations are also investigated, as is the correlation with magnetic activity. It is found that the irregular variations have approximately the same latitude dependence as the 27-day peak, and decrease roughly exponentially with increasing frequency. There is some correlation between magnetic activity and cosmic-ray variations, but it shows no clear recurrence tendencies. A general review of power spectral analysis is included. The conclusions from the results and the connection between Forbush decreases and the 27-day variation, are also discussed. (auth)

21243 ON THE ANOMALOUS COMPONENT OF LOW-ENERGY GEOMAGNETICALLY TRAPPED PROTONS. A. M. Lenchek (Goddard Space Flight Center, Greenbelt, Md.). J. Geophys. Research, 67: 2145-57 (June 1962).

The energy spectrum of trapped protons shows a pronounced variation with latitude at energies <30 Mev. An anomalous, low-energy component is found on relatively high magnetic shells in the inner zone. The interpretation in terms of the decay of albedo neutrons generated in the polar caps by solar cosmic rays is examined. This interpretation requires that the inner shells, where a normal spectrum is seen, should be shielded from the polar source. The intensity of albedo neutrons as a function of energy, latitude, and zenith angle is computed. The injection rate into specific trapped orbits is then evaluated, and it is shown that those orbits where no anomalous component exists cannot be populated by the solar cosmic-ray mechanism, whereas the orbits where the anomalous component is seen can be populated. Assuming adiabatic trapping in this low-energy region, lifetimes are long compared with the average intervals between large injection events. Therefore, the anomalous component may represent an equilibrium phenomenon rather than a transient. This component should extend into the outer belt. (auth)

21244 PITCH ANGLE DISTRIBUTIONS AND MIRROR POINT DENSITIES IN THE OUTER RADIATION ZONE. T. A. Farley and N. L. Sanders (Space Technology Labs., Redondo Beach, Calif.). J. Geophys. Research, 67: 2159-68 (June 1962).

A method is presented for the calculation of the equatorial pitch angle distribution (unidirectional intensity distribution) of trapped radiation from the count rate of an omnidirectional detector along a line of force. An expression is derived for the calculation of the mirror-point density from the equatorial pitch angle distribution. The method is applied to data obtained from scintillation and proportional counters on the Explorer VI satellite. The results from the scintillation counter show a relative absence of electrons with pitch angles of 90° during quiet periods, a sharp increase in such particles shortly after a sudden commencement magnetic storm, and restoration of the prestorm distribution at a higher intensity level after the storm. The results from the proportional counter are qualitatively similar, with the exception of the apparent deficiency of 90° pitch angles during quiet periods, which does not appear. (auth)

21245 ON THE EFFECT OF GEOMAGNETIC FLUCTUATIONS ON TRAPPED PARTICLES. Leverett Davis, Jr. and David B. Chang (California Inst. of Tech., Pasadena). J. Geophys. Research, 67: 2169-79 (June 1962).

The effect of large-scale geomagnetic fluctuations on Van-Allen-belt particles with mirror points near the geomagnetic equatorial plane is studied in a model in which a dipole field is perturbed by the sudden approach and adiabatic withdrawal of a perfectly conducting plane. The Fokker-Planck equation for the particle density is obtained by following the motions of the particle guiding centers, assuming that the first and second adiabatic invariants, but not the third, remain valid during the approach. Steady-state and transient solutions for several cases are obtained. The steady-state solution for the density of particles with a particular nonrelativistic energy E, due to a source producing the density $KE^{-(s+1)}$ at an intermediate radius with sinks at very large and very small radii, varies

with radius r approximately as r^{-4-3s} inside the source region and as r^{-11-3s} outside it. (auth)

21246 ON THE EFFECT OF A RING CURRENT ON THE TERMINAL SHAPE OF THE GEOMAGNETIC FIELD. John R. Spreiter and Alberta Y. Alksne (Ames Research Center, Moffett Field, Calif.). J. Geophys. Research, 67: 2193-2205 (June 1962).

The interaction between a neutral stream of ionized solar corpuscles and the combined magnetic fields of a three-dimensional dipole and an equatorial ring current is investigated. It is assumed that the stream is confined to the exterior and the magnetic field to the interior of a hollow, the boundary of which is defined by a thin current sheath. The shape of the hollow is sought by application of an approximate method of solution. Results are presented for the traces of the boundary in the equatorial plane and the meridian plane containing the dipole axis and the sun-earth line for the case in which the diple axis is normal to the sun-earth line. It is found that the presence of the ring current has the effect of greatly increasing the size, as well as altering the form, of the region bounded by the current sheath. The calculated results are, moreover, in essential agreement with the observations when representative values are inserted for the properties of the ring current and the solar corpuscular stream. (auth)

21247 IONOSPHERIC ELECTRON CONTENT AND VARIATIONS MEASURED BY DOPPLER SHIFTS IN SATELLITE TRANSMISSIONS. Fernando de Mendonça (Stanford Univ., Calif.). J. Geophys. Research, 67: 2315-37 (June 1962).

A method is derived for calculating ionospheric electron content by comparison of the Doppler shifts imparted to two harmonically related frequencies transmitted from a satellite. This Doppler method is applied in the analysis of many passages of the satellite Transit 2-A (1960η_1) during July through October 1960. The observations are made at Stanford, California, at 54 Mc and its sixth harmonic. Differences in the electron content of 25 per cent between two subionospheric points separated by as little as 1000 km are observed on several passages during magnetically quiet days. On some magnetically disturbed days these differences increase to over 50 per cent for the same separation. A very strong magnetic storm is shown to decrease the early-afternoon electron content to almost a normal nighttime value over the range of latitudes surveyed. Other less intense storms are observed to decrease the electron content to the north and to increase it to the south of the observer. The day-to-day variations of electron content at a given latitude on magnetically quiet days are observed to be about ±15 per cent from the mean; however, less frequently, variations as large as ±50 per cent are observed. Unlike the variations on the magnetically disturbed days, these variations do not seem to modify the horizontal gradients normally found. (auth)

21248 SCATTERING OF COSMIC RAY MUONS WITH MOMENTA BETWEEN 298 AND 773 Mev/c IN IRON AND TIN. M. A. Meyer, J. A. M. De Villiers, N. S. Wolmarans, J. W. Koen, and I. J. Lessing (Potchefstroom Univ. for C.H.E., South Africa). Nuclear Phys., 32: 71-81 (Apr. 1962). (In English)

The scattering of cosmic muons in iron and tin at 298 to 773 Mev/c was studied using a counter hodoscope. This momentum region was divided into two ranges. The experimental angular distributions are consistent with Cooper and Rainwater's theory and inconsistent with Molière's theory. The effective nuclear radius for muon scattering approximates that found in electron scattering experiments. Widths of experimental distributions are compared with theoretical widths. (auth)

21249 INTEGRAL SPECTRUM OF IONIZATION PULSES CAUSED BY NUCLEAR ACTIVE PARTICLES OF COSMIC RADIATION AT MOUNTAIN ALTITUDES. N. L. Grigorov (Moscow Univ.), C. A. Tretyakova, V. J. Shestopierov, C. P. Babayan, N. G. Bayadsyan, Z. Buja, J. Zoskiewicz, J. Massalski, and A. Oleś. Nukleonika, 7: 61-73 (1962). (In English)

An investigation of ionization pulses caused by nuclear active particles at sea level and at mountain altitudes (3200 m above sea level) was undertaken with an apparatus composed of 6 trays of 10-m^2 ionization chambers separated by graphite and lead absorbers. Pulses could be registered by μ mesons and nuclear active particles. Integral pulse spectra caused by μ mesons in the pulse-height interval $3 \times 10^3 \leq I \leq 3 \times 10^4$ particles were exponential with an exponent $\gamma = 2.22 \pm 0.14$. The integral pulse spectrum caused by nuclear active particles in the same pulse-height interval was also exponential with $\gamma = 1.62 \pm 0.04$. (auth)

21250 THE CHEMICAL COMPOSITION OF THE PRIMARY COSMIC RADIATION ABOVE THE EARTH'S ATMOSPHERE. R. R. Daniel and N. Durgaprasad (Tata Inst. of Fundamental Research, Bombay). Nuovo cimento (10), 23: 82-111 (1962). (In English)

The chemical composition of nuclei heavier than Be in primary cosmic radiation was studied as a function of atmospheric depth between 8 and 40 g/cm^2 by observing tracks recorded in a vertical and a horizontal stack of nuclear emulsions flown from Texas, at 6.6 g/cm^2. It is advantageous to divide the H-group of nuclei (which consists of all elements with charge $Z \geq 10$) into three subgroups: the H_1, H_2, and H_3 nuclei comprising charge values 20 to 28, 16 to 19, and 10 to 15 respectively. Evidence shows that the ratio H/M of the number of H nuclei to the M nuclei, (C, N, O, F), slowly increases between 8 and 40 g/cm^2; the value at the top of the atmosphere is 0.30 ± 0.02. The proportion of boron nuclei compared to the S nuclei ($Z \geq 6$) outside the earth's atmosphere was obtained; the value is $(14 \pm 5)\%$. The ratio $L(0)/S(0)$ is estimated to be 0.24 ± 0.09. The absorption mean free paths Λ_i' of the H_1, H_2, H, and M nuclei in air were 16.3 ± 4.7, 54.9 ± 16.2, 54.3 ± 20.6, and 29.7 ± 2.9 g/cm^2, respectively. It is likely that $\Lambda_H > \Lambda_M'$ for depths below 40 g/cm^2. The flux of the H_1, H_2, H, M, and boron nuclei at the top of the atmosphere is 0.71 ± 0.23, 1.42 ± 0.14, 2.07 ± 0.28, 6.69 ± 0.39, and 1.66 ± 0.58 particles/m^2 s sr respectively; the flux of the H_2 nuclei is estimated to be ≤ 0.11 particles/m^2 s sr. (auth)

21251 THE ATTENUATION LENGTH OF EXTENSIVE AIR SHOWERS IN AIR. P. C. Bhattacharya, T. Gémesy, T. Sándor, A. Somogyi, and L. Uray (Central Research Inst. of Physics, Budapest). Nuovo cimento (10), 24: 290-300 (Apr. 16, 1962). (In English)

A multiplate cloud chamber was controlled by G-M counters and photographs in which the directions of the shower axes could be determined a) from the directions of one or more energetic particles or b) from the directions of parallel particles were selected. From the distribution of the projected zenith angles of the shower axes the following values of the attenuation length (Λ) were obtained: a) $\Lambda = 85 \pm 5$ gcm^{-2}, and b) $\Lambda = 101 \pm 8$ gcm^{-2}. (auth)

21252 THE 27-DAY RECURRENCE TENDENCY IN THE MUON INTENSITY OF COSMIC RADIATION MEASURED AT 40 m w.e. UNDERGROUND. T. Sándor, A. Somogyi, and F. Telbisz (Central Research Inst. of

Physics, Budapest). Nuovo cimento (10), 24: 316-23 (Apr. 16, 1962). (In English)

The existence of the 27-day recurrence tendency was investigated in the muon intensity observed at a depth of 40 m water equivalent. From Feb. 20, 1958 to Dec. 31, 1960, two series of 27-day variation could be selected on the basis of the F-test. The value of the amplitude for each series was ~1%. (auth)

21253 ALTITUDE-DEPENDENCE OF RELATIVE AMPLITUDE DURING FORBUSH DECREASES AT DIFFERENT LATITUDES. Lekh Vir Sud and P. S. Gill (Gulmarg Research Observatory, India). Nuovo cimento (10), 24: 411-13(May 1, 1962). (In English)

Relative amplitude of four cosmic-ray decreases for six stations were calculated. The stations are so chosen that they form three sets, each situated at a different latitude and the two stations of every set having different altitudes. The change in relative amplitude per 1000-m increase in altitude—altitude factor—is latitide-dependent. The attenuation length is more strongly rigidity-dependent during the cosmic ray storm period than otherwise. (auth)

21254 THE INTENSITY OF PRIMARY COSMIC RAY HELIUM NUCLEI ON APRIL 28th, 1961. G. R. Stevenson (Univ. of Bristol, Eng.). Nuovo cimento (10), 24: 557 (May 1, 1962). (In English)

The intensity of He nuclei in primary cosmic radiation was determined in a stack of nuclear emulsion exposed on Apr. 28, 1961 for 190 min at 29.5 to 32 km over Fife, Scotland. The stack consisted of 10 Ilford G5, 600 μ, stripped emulsions 10 cm × 10 cm. The time-altitude curve was obtained from continuous radar observations of balloon positions. Data are presented in graphical form. (L.N.N.)

21255 OBSERVATIONS ON EXTENSIVE AIR SHOWERS. IX. AN EXPERIMENTAL INVESTIGATION INTO THE MU-MESON COMPONENT BY MEANS OF TRIGGERED SPARK COUNTERS. J. F. de Beer, T. E. Cranshaw, and A. G. Parham (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Phil. Mag. (8), 7: 499-514(Mar. 1962).

Measurements of the attenuation length, energy spectrum, and distribution of heights of origin of the μ-meson component of air showers containing about 10^7 particles are described. All measurements are compared with the results of other investigators and with the prediction of various shower theories. The energy spectrum obtained for μ-mesons deviates strongly from spectra obtained by other investigators. The distribution of heights of origin is incompatible with existing shower theories. (auth)

21256 IDENTIFICATION OF PROTONS, MUONS, AND ELECTRONS IN THE SOFT COMPONENT OF COSMIC RADIATION AND MEASUREMENT OF THEIR ENERGY SPECTRA. G. Wibbernez (Institut für Reine und Angewandte Kernphysik, Kiel). Z. Physik, 167: 284-301(1962). (In German)

An apparatus is described which permits the muons, protons, and electrons of the soft component of cosmic radiation falling within a given spatial angular range to be identified. Their ionizing values were determined as a function of the range of the particles using two scintillation counters which were placed under a 2-cm-thick lead screen. Through a knowledge of distribution curves of the energy losses by the Symon theory and by application of the Wilson approximation shower theory for lead, it was possible to indicate a behavior typical for each particle type. This was confirmed experimentally. The differential intensities measured at sea level with 4 to 10 cm lead equivalent agree essentially with results previously reported. An expansion of the method to the identification of photons and increase of the measurement range to the interval from 1 to 15 cm lead equivalent is possible. (tr-auth)

Criticality Studies

21257 (BAW-1216) MARTY CRITICAL EXPERIMENTS—SUMMARY OF 4%-ENRICHED UO_2 CORES STUDIED FOR NMSR. R. M. Ball, A. L. MacKinney, and J. H. Mortenson (Babcock and Wilcox Co. Critical Experiment Lab., Lynchburg, Va.). May 1961. Contract AT(30-3)-274, 231p.

A description is given concerning experiments to provide nuclear design information for the NS Savannah propulsion system. Experiments were run on a variety of core configurations and conditions which approximated the reference core in most cases. Included are sections on facilities and equipment, fuel, designation of cores, critical configurations, thermal disadvantage factor, control rod calculations, temperature effects, power distribution reactivity effects, and multiplication. (J.R.D.)

21258 CRITICALITY INVESTIGATIONS ON U^{235}-IMPREGNATED CELLULOSE SHEETS. W. Stumm and H. Groll. Atomwirtschaft, 7: 215-17(Apr. 1962). (In German)

The criticality of arrangements of fissionable material with various moderators cellulose is considered. The proposals of the International Parkinson Committee (ICP) essentially amount to the achievement of a self-limitation of the document situation in nuclear organizations of every kind by prescribing the exclusive use of writing paper containing a homogenous distribution of U^{235}. In the piling-up of U^{235} impregnated cellulose sheets in the form of NSP (Nuclear Standard Paper) it is necessary to distinguish between the criticality of the U^{235} embedded in the sheets acting as a moderator (Nuclear Criticality) and the conventional or bureaumetric criticality. Various safety considerations are to be observed in the case of the building up of critical masses of NSP. The use of blotting pads made of cadmium and gadolinium paper weights permits especially high piles. The NSP fuel element arises from the concentration of 300 NSP in up to 2 mm thick cladding, for which cardboard is used in place of zirconium. A subcritical assembly results from the piling up of such fuel elements in filing cabinets. This situation must be avoided because of the danger of a critical state through changes in the geometry, e.g., through tearing of the files. The same safety regulations apply to the store of useless fuel material (Archives). (auth)

21259 CONDITIONS FOR STABILITY IN CHAIN REACTIONS. R. C. L. Bosworth and C. M. Groden (Univ. of New South Wales, Kensington, Australia). J. Proc. Roy. Soc. N. S. Wales, 95: 189-94(1962).

The conditions for stability in chain reactions in 1, 2, and 3 dimensions were investigated. In each case a critical maximum size of the vessel was found, beyond which no steady state is possible. (auth)

Elementary Particles and Radiations

21260 (AFOSR-2409) INTRODUCTORY LECTURES ON SCATTERING THEORY. Physics Department Technical Report No. 243. O. W. Greenberg. Notes by L. L.

Hirst and P. N. Dobson (Maryland. Univ., College Park). Jan. 1962. Contract AF49(638)-24. 79p.

Notes on 12 lectures on non-relativistic scattering theory are presented. Topics covered in the wave packet treatment of scattering include requirements on initial (unscattered) wave packet, motion of free packet, scattering solutions of Schrödinger equation, scattering length and effective range theory, and resonant scattering. Discussions of the formal theory of scattering include Møller wave operators and the S-matrix, scattering in the Dirac picture, adiabatic switching, the T-matrix and cross sections, the generalized optical theorem, the two-interaction problem, and Levinson's theorem. (M.C.G.)

21261 (AFOSR-TR-60-172) SOLUTIONS OF A MODIFIED DIRAC EQUATION. Final Technical Report. Zeno V. Chraplyvy (Saint Louis Univ.). Nov. 15, 1960. Contract AF 49(638)-567. 37p.

The results obtainable from the Dirac equation were compared with those from a modified Dirac equation. For an electron in a central electrostatic field they read $(E - mc^2\beta)\psi(\vec{p}) - C\vec{\alpha}\cdot\vec{p}\,\psi(\vec{p}) = -(e^2/2\pi^2\hbar)\int d^3k\ 1/k^2\psi(\vec{p}+\vec{k})$ and $(E - mc^2\beta\psi(\vec{p}) - C\vec{\alpha}\cdot\vec{p}\,\psi(\vec{p}) = [\frac{1}{2} + (mc^2\beta/2\sqrt{m^2c^4 + c^2p^2})] - (e^2/2\pi^2\hbar)]\int d^3k\ 1/k^2\psi(\vec{p}+\vec{k})$ respectively. The latter places the electron in a space with the negative energy states almost completely filled, where according to the old Dirac equation, the electron tends to fall into one of them. The equations were applied to the Kepler problem and the Klein problem. (M.C.G.)

21262 (CERN-62-8) DETECTION ET PRODUCTION DE LA POLARISATION DE PARTICULES UTILISANT LES METHODES DE LA PHYSIQUE ATOMIQUE. (Detection and Production of Polarized Particles Utilizing the Methods of Atomic Physics). L. Madansky (European Organization for Nuclear Research, Geneva). Feb. 2, 1962. 19p.

The hamiltonian describing the interaction in a system composed of an electron and a positive particle of spin $\frac{1}{2}$ and state s, placed in a magnetic field, is analyzed to determine the states, wave functions, and energy of the two particles with spin $\frac{1}{2}$. Applications of this analysis to the detection of polarization in a positron beam, muon beam, and proton beam are described. (J.S.R.)

21263 (CERN-62-14) ELEMENTARY PARTICLE PHYSICS. LECTURE COURSES GIVEN AT CERN IN 1961. B. T. Feld (European Organization for Nuclear Research, Geneva). Mar. 21, 1962. 95p.

Included are chapters on definitions, classification, properties of the meson field, emission and absorption of mesons, classification schemes for mesons and baryons, particle list completeness evaluation, and the Fermi-Watson theorem. (J.R.D.)

21264 (JINR-D-820) ELASTIC SCATTERING OF Λ-HYPERONS AND K_1^0-MESONS ON HYDROGEN. B. A. Arbuzov, E. (Ye.) N. Kladnitskaya, V. N. Penev, and R. N. Faustov (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Theoretical Physics and Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of High Energy). 1962. 11p.

Elastic scattering of Λ hyperons and K^0 mesons was investigated. The elastic scattering cross sections were estimated on the basis of the 20 observed events of the reaction $\Lambda + p \rightarrow \Lambda + p$ and of the 16 events of the reaction $K_1^0 + p \rightarrow K_1^0 + p$. The angular and momentum distributions of the scattered particles are presented. The experimental data on 500 to 1500 Mev/c Λ hyperon scattering are compared with the theoretical calculations. (auth)

21265 (NP-11600) CIRCULAR POLARIZATION OF GAMMA RAYS FROM NEUTRAL PARTICLE DECAYS. Haakon Olsen (Norges Tekniske Høgskole, Trondheim. Institutt for Teoretisk Fysikk) and L. C. Maximon (National Bureau of Standards, Washington, D. C.). 1962. 11p.

For presentation at Physics Seminar No. 1, Trondheim, 1962.

The use of pair production to measure the circular polarization of high-energy photons is discussed. The correlation between the circular polarization of a gamma ray and the direction of motion of the pair particles is given. Some possible experimental applications of the method are considered, particularly the measurement of the polarization of the Σ^0 produced in the reaction $\pi^- + p \rightarrow \Sigma^0 + K^0$. (D.L.C.)

21266 (NP-11680) DIRECT REACTIONS VIA SINGLE PARTICLE MODES. S. Bloom (Buenos Aires. Universidad. Facultad de Ciencias Exactas, Físicas y Naturales). July 1961. 33p.

The direct reaction mode is reviewed. Qualitative descriptions are given for a few theoretical approaches to the general problem. Their areas of application are illustrated with examples drawn directly from the field of experimental nuclear physics. (M.C.G.)

21267 (UCRL-9875(Vol.2)) LECTURES ON THE S-MATRIX THEORY. Lectures IX thru XII Covering Period: November 13, 1961–December 4, 1961. Henry P. Stapp (California. Univ., Berkeley. Lawrence Radiation Lab.). Contract W-7405-eng-48. 59p.

Lectures on the S-matrix theory are presented. Topics covered include: singularities required by unitarity, Landau conditions, and the physical sheet. (M.C.G.)

21268 (UCRL-10140) REGGE TRAJECTORIES FOR A SINGLE ATTRACTIVE YUKAWA POTENTIAL. Akbar Ahmadzadeh, Phillip G. Burke, and Cecil Tate (California. Univ., Berkeley. Lawrence Radiation Lab.). Mar. 27, 1962. Contract W-7405-eng-48. 10p.

The Regge trajectories of the poles in the S matrix for nonrelativistic scattering by a single attractive Yukawa potential were investigated. They were found to be closed loops in the complex angular-momentum plane starting from, and returning to, the negative integers as the energy goes from $-\infty$ to $+\infty$. Detailed results are graphically presented. (auth)

21269 (FTD-TT-61-23) ANALYSIS OF POSSIBILITIES OF UTILIZING THE GYROSCOPIC EFFECT OF ORBITAL MOTION OF ELEMENTARY PARTICLES FOR MEASURING ANGULAR VELOCITY. Andrzej Bialecki. Translated from Pomiary, Automatyka, Kontrola, 6: 386-91(1960). 22p.

This paper is also available as RAE-Lib-Trans-971.

Theory associated with the electron gyroscope is discussed. It is noted that production of such gyroscopes is in the future however the advantages of frictionless operation point to the merits of a thorough examination of the concept. (J.R.D.)

21270 (UCRL-Trans-825) ON THE THEORY OF PRODUCTION OF MANY PARTICLES. I. Pomeranchuk. Translated by Sergey Shewchuck (Univ. of California Lawrence Radiation Lab., Berkeley) from Doklady Akad. Nauk S.S.S.R., 78: 889-91(1951). 11p.

The discussion is centered around the inapplicability of the excitation theory in high-energy interactions of nucleons with the π-meson field. Arguments are given to support the conclusion that the particles in such interactions will be strongly interacting with one another and that each particle formed continues to interact with those remaining as a result of which the number of particles grows rapidly. The expansion takes place in all directions with a velocity on

the order of that of light, after which the particles fly apart without further interaction. (J.R.D.)

21271 REMARKS ON THE "EFFECTIVE TARGET MASS." Ziro Koba and Andrzej Krzywicki (Inst. for Nuclear Research, Warsaw). Acta Phys. Polon., 21: 153-74 (1962). (In English)

The concept of "target mass," as defined by Birger and Smorodin, is examined within the general framework of kinematics and by applying the one-pion-exchange model with pole approximation. This quantity should be regarded as a parameter measured by experiment which can give, if properly defined and combined with other quantities, information concerning the collision mechanism, such as the magnitude of the invariant energy-momentum transfer. It may lead to confusion if it is too naively interpreted as the mass of a latent particle or too straightforwardly related to the nucleon structure. (auth)

21272 RECENT ADVANCES IN PION AND MUON PHYSICS. [PART] I. A. W. Merrison (Univ. of Liverpool). Advances in Phys., 11: 1-37(Jan. 1962).

Muon and pion data are presented. Decay parity violation, masses, lifetimes, and rare decay modes of muons and pions are discussed. Muon magnetic and electric dipole moments are given. (L.N.N.)

21273 CHARGE TRANSFER. D. R. Bates and R. McCarroll (Queen's Univ., Belfast). Advances in Phys., 11: 39-81(Jan. 1962).

High-velocity approximations, in which the perturbation causing transition is taken to be the interaction potential, and low-velocity transitions, in which the perturbation is taken to be the relative motion, are considered. (L.N.N.)

21274 DEUTERON CAPTURE BY DEUTERONS AND THE STRUCTURE OF ^{4}He. L. M. Delves (Univ. of New South Wales, Kensington, Australia). Australian J. Phys., 15: 59-69(Mar. 1962).

The four-body scattering matrix describing scattering states of two protons and two neutrons is analyzed to determine the structure of the bound state, He^4. An estimate can be given of the fraction of time that He^4 appears as two deuterons; this is used to calculate the cross sections for the process $d(d,\gamma)He^4$. The low energy $n\text{-}He^3$ singlet elastic scattering parameters are apparently determined by the data studied. (auth)

21275 NEW FUNDAMENTAL PARTICLE DISCOVERED, THE ANTI-XI-MINUS. CERN Courier, 2: No. 3, 4-5(Mar. 1962). (In English)

Methods by which the $\bar{\Xi}^-$ was discovered are discussed. Identification was accomplished through precise measurements and analysis of a bubble-chamber photograph. (L.N.N.)

21276 NUCLEAR PHYSICS — THE HYPERONS. Louis Leprince-Ringuet (College de France, Paris). Énergie nucléaire, 4: 135-6(Mar.-Apr. 1962). (In French)

An outline is given of the properties of hyperons, viz. mass, decay modes, asymmetry parameters and polarization, multiplet structure, strangeness, hyperfragment formation, and relativistic dynamics. (T.F.H.)

21277 SOME PROPERTIES OF IMPEDANCE AS A CAUSAL OPERATOR. Tai Tsun Wu (Harvard Univ., Cambridge, Mass.). J. Math. Phys., 3: 262-71(Mar.-Apr. 1962).

As a model for problems connected with domains of analyticity and dispersion relations, the concept of impedance (self-impedance) was studied under the physical requirements of linearity, passivity, reproducibility, and causality. After identifying impedance functions with suitably defined positive functions, any impedance function may be decomposed to the sum of a minimum reactive part and two reactive parts, one of which is of unfamiliar nature. In the time domain, the convolution representation of the current in terms of the voltage and vice versa are obtained rigorously. A reactance obtained from the Cantor function is studied in detail. Its peculiar delta-function response is computed explicitly, and it is used to construct a counter example to a representation by van Kampen of the S matrix of a Maxwellian field. The general results are applied to study the Kronig-Kramers dispersion relations for dielectric constants. It is proved that one of the two relations is true under very general conditions, but the other is false in general. (auth)

21278 CONVERGENCE OF PERTURBATION EXPANSIONS IN CUTOFF MESON THEORIES. William M. Frank (Naval Ordnance Lab., Silver Spring, Md.). J. Math. Phys., 3: 272-80(Mar.-Apr. 1962).

It is proved that the perturbation expansion of matrix elements for a class of meson theories has a nonzero radius of convergence. Included are theories describing bosons of nonvanishing mass, coupled linearly of bilinearly to fermions (but not antifermions) via an interaction which cuts off or attenuates sufficiently rapidly for high boson momenta. By bounding the propagators by their values for zero boson momentum, a majorizing series to the perturbation expansion converging geometrically is obtained. (auth)

21279 APPLICATION OF THE SINGULAR WAVE FUNCTION OPERATOR IN SCATTERING THEORY. [PART] II. Robert A. Mapleton (Air Force Cambridge Research Labs., Bedford, Mass.). J. Math. Phys., 3: 297-304(Mar.-Apr. 1962).

The singular wave function matrix of Moller was used to obtain the scattering solution for the nonrelativistic Coulomb operator. This singular wave function operator is defined differently. This definition is deduced from the relation of the characteristic form of the Green's function to the branch cut in the continuous part of the spectrum of the Green's function. As a consequence, the previous calculation difficulties do not occur. This method is also used to obtain the scattering solution for the attractive square-well potential. (auth)

21280 SUPERSELECTION PRINCIPLE AND PURE STATES OF n-IDENTICAL PARTICLES. A. Galindo, A. Morales, and R. Nuñez-Lagos (Junta de Energía Nuclear, Madrid). J. Math. Phys., 3: 324-8(Mar.-Apr. 1962).

Wightman's assumption of commutative superselection rules is equivalent to Jauch's assumption of existence of a complete set of commuting observables. The analysis of coherence is carried out using the Gel'fand representation theory, and the general structure of the complete sets of compatible observables is given when the Hilbert space is separable. The equivalence provides physical grounds to incorporate both assumptions into the axiomatic foundations of quantum theory as a single "superselection principle." To illustrate how this principle works, the problem of determining the physically realizable states of an assembly of n-identical particles is analyzed and solved. (auth)

21281 TRAVELING-WAVE TECHNIQUE OF CYCLOTRON RADIATION. P. Parzen and G. Nomicos (Republic Aviation Corp., Farmingdale, N. Y.). J. Math. Phys., 3: 372-81(Mar.-Apr. 1962).

A traveling-wave technique of computing the radiation from accelerated electrons is described. In contrast to the usual method which expands the field due to the moving electrons in spherical waves, an expansion in traveling

waves along a preferred direction is utilized. This method is suitable in cases in which the radiation is confined by cylindrical conducting boundaries or plasmas. Radiation from an electron in circular motion is considered in free space and within a coaxial conducting cylinder, and from an electron in a variable-pitch helical orbit. (auth)

21282 MOBILITY OF ELECTRONS IN INTENSE ELECTRIC FIELDS. A. V. J. Martin and J. Le Mée (Carnegie Inst. of Tech., Pittsburgh). J. phys. radium, 23: 7-11(Jan. 1962). (In French)

As a continuation of work on the constant mobility theory of the tecnetron, the problem was considered in the case of nonconstant mobility. A general survey of literature dealing with electron mobility in high electric field intensities was made. The results of this review are summarized. It is concluded that as a first approximation an $E^{-\frac{1}{2}}$ law can be adopted for mobility beyond the critical field. (auth)

21283 THE PROBLEM OF MOTION IN ASYMMETRIC FIELD THEORY. Nguyen Phong Chau (Institut Henri-Poincaré, Paris). J. phys. radium, 23: 17-21(Jan. 1962). (In French)

A discussion is given of the problem of movement within the framework of a generalized version of the Einstein-Schrödinger unified field theory, using the method of singularities. (auth)

21284 WAVE FUNCTIONS AND MATRIX ELEMENTS FOR TRITON. L. Cohen and J. B. Willis (Univ. of Southampton, Eng.). Nuclear Phys., 32: 114-27(Apr. 1962). (In English)

Methods developed for the alpha particle are used to describe the functions which can occur in the ground state wave function of H^3. Isobaric spin, spin, orbital angular momentum, and internal functions are classified according to their behavior under permutations of the three particles, and combined to form completely antisymmetric functions. Three S-state functions, four P-state functions, and four D-state functions are obtained. The kinetic energy and potential matrix elements are summed over spin and isobaric spin and integrated over all possible orientations of the nucleus, and are obtained as integrals over interparticle distances only. (auth)

21285 THE PROTON-NEUTRON MASS DIFFERENCE. Toshiro Okui (Tokyo Univ.). Nuclear Phys., 32: 401-10 (May 1962). (In English)

To explain the negative value of the proton-neutron mass difference, the electromagnetic effect of the pion cloud is investigated. The cut-off method and renormalization of the coupling constants are used in a fourth-order perturbation calculation. Two kinds of cut-off momenta, 1 nucleon mass for the virtual meson and 1.46 nucleon mass for the virtual photon, prove plausible to obtain the observed mass difference. The break-down of charge independence for the renormalized coupling constants is discussed. (auth)

21286 EXPERIMENTAL RESULTS ON PROTON NUCLEON COLLISIONS AT 27 Gev. Y. Baudinet-Robinet (Université, Liège), M. Morand, Tsai-Chü, C. Castagnoli, G. Dascola, S. Mora, A. Barbaro-Galtieri, G. Baroni, and A. Manfredini. Nuclear Phys., 32: 452-69(May 1962). (In English)

Results of elastic proton-proton and inelastic proton-nucleon interactions at 27 Bev were obtained, using the emulsion technique. On ≈1 km of followed track, $\sigma_{el} = 5.3 \pm 1.7$ mb and $\sigma_{in} = 28.5 \pm 3.0$ mb. The mean momentum of the charged secondaries in the barycentric system is $\langle p_\pi \rangle = 450 \pm 30$ Mev/c; the transverse momentum is almost constant and is $\langle p_\perp \rangle = 180 \pm 12$ Mev/c. The inelasticity coefficient for p-p collisions is $K = 0.38 \pm 0.04$. (auth)

21287 POSSIBLE RESONANCES IN Ξ p REACTIONS. Alladi Ramakrishnan, T. K. Radha, and R. Thunga (Inst. of Mathematical Sciences, Madras). Nuclear Phys., 32: 517-23(May 1962). (In English)

Cross sections and angular distributions of Ξ-N interactions are investigated to determine the possibilities of Y*, Y-Y, and Y-N resonances. (auth)

21288 ON THE IONIZATION BY RELATIVISTIC PARTICLES IN XENON-HELIUM MIXTURES. T. Aggson and W. B. Fretter (Univ. of California, Berkeley). Nuovo cimento (10), 23: Suppl. No. 1, 75-81(1962). (In English)

Ionization produced by relativistic electrons at 150 to 550 Mev was measured in H, He, Xe, and Xe–He mixtures, using an ionization chamber in the beam of the Stanford linear electron accelerator. Results agree with theoretical predictions. (auth)

21289 PRELIMINARY RESULTS ON Y_1^* AND K* PRODUCTION IN π-p COLLISIONS. A. R. Erwin, R. H. March, and W. D. Walker (Univ. of Wisconsin, Madison and Brookhaven National Lab., Upton, N. Y.). Nuovo cimento (10), 24: 237-47(Apr. 16, 1962). (In English)

One hundred ninety-four cases of $\pi^- + p \rightarrow$ hyperon + kaon + π were observed in liquid hydrogen. Analysis shows evidence for the production of K* excited mesons in association with Σ^- and Σ^0 but not with Λ^0. Y_1^* production in association with kaons was observed; the Y_1^* appears to be strongly polarized. Data suggest that the Y_1^* has spin = ½ and negative parity with respect to the Λ^0, but results are not statistically conclusive. (auth)

21290 ANALYTIC PROPERTIES OF PARTIAL DIFFERENTIAL CROSS-SECTIONS. I. T. Drummond (Univ. of Cambridge, Eng.). Nuovo cimento (10), 24: 248-77 (Apr. 16, 1962). (In English)

The relationship between singularities of the invariant amplitude for a production process and singularities of the partial differential cross section proposed by Chew and Low is analyzed. The effect of normal and of anomalous thresholds is discussed. (auth)

21291 SOME CONSEQUENCES OF THE DECAY MODES AND PRODUCTION OF THE NEW HEAVY BOSONS. G. Feldman, T. Fulton, and K. C. Wali (Johns Hopkins Univ., Baltimore). Nuovo cimento (10), 24: 278-89 (Apr. 16, 1962). (In English)

Consequences following production and decay of discovered heavy bosons are investigated. Correlation experiments can determine their spins and parities and their polarization states arising from the production process. A study of leptonic decay modes can throw light on the electromagnetic structure of the leptons. (auth)

21292 FERMION-LIKE TREATMENTS OF FERMION PAIRS. J. Osada (Universidade de São Paulo, Brazil). Nuovo cimento (10), 24: 301-15(Apr. 16, 1962). (In English)

An equation is presented by which the energy of many-fermion systems can be calculated in an approximation similar to that of the effects of hole-hole interactions. Though the effect of hole motions can be considered using the Iwamoto equation when the interactions between fermions are repulsive or weakly attractive, some of the eigenvalues become complex when it is applied to a system having strongly-attractive interactions. (auth)

21293 ELASTIC SCATTERING $\pi^+ + p$ AT 1.0 Gev. U. Bidan (Centre d'Etudes Nucléaires, Saclay, France), F. Lévy, N. Abbattista, A. Minafra, S. Mongelli, A. Romano, and P. Waloschek. Nuovo cimento (10), 24: 334-42 (Apr. 16, 1962). (In English)

The angular distribution π^+-p at 1.0 Bev was determined from 1032 events measured in a propane bubble chamber. Comparison is made with data at 820 and 900 Mev and with angular distributions π^- + p at similar energies. (auth)

21294 CHANNEL-SPIN AND ANALYTICITY OF THE SPECTRAL FUNCTION. G. Mohan (National Physical Lab., New Delhi). Nuovo cimento (10), 24: 350-2(Apr. 16, 1962). (In English)

The contribution to the imaginary part of the scattering amplitude from any intermediate state of definite channel-spin (total angular momentum in the center-of-mass system) is shown to be analytic in the entire complex plane of the momentum-transfer variable. (auth)

21295 HOLOMORPHY DOMAIN OF THE S-MATRIX IN POTENTIAL SCATTERING. A. Bottino and A. M. Longoni (Universita, Turin and Istituto Nazionale di Fisica Nucleare, Turin). Nuovo cimento (10), 24: 353-68 (Apr. 16, 1962). (In English)

The holomorphy domain of the S-matrix in the case of potentials V(z), analytic and conveniently bounded in the right half plane of z, is considered. A method of T. Regge (Nuovo Cimento, 18: 647(1960)) is used. (auth)

21296 LOW-ENERGY K^+-NUCLEON SCATTERING. Alladi Ramakrishnan, A. P. Balachandran, and K. Raman (Univ. of Madras). Nuovo cimento (10), 24: 369-78(May 1, 1962). (In English)

Using the phase shifts given by L. S. Rodberg and R. M. Thaler, an analysis of low energy S-wave K^+-nucleon scattering is carried out assuming that the scattering amplitude is dominated by the Σ and Λ poles and the $\Lambda\pi$, $\Sigma\pi$, and $\pi\pi$ resonances. (auth)

21297 THE LEFT-HAND CUT DISCONTINUITY AND EQUIVALENT POTENTIALS. K. Chadan (Laboratoire de Physique Théorique et Hautes Energies, Faculte des Sciences, Orsay, France). Nuovo cimento (10), 24: 379-84 (May 1, 1962). (In English)

It is shown that the potential obtained by A. Martin (Nuovo cimento, 19: 1257(1961)) from the left-hand cut discontinuity of the S-matrix is that particular member of the phase-equivalent family which decreases at infinity faster than all others. (auth)

21298 GLOBAL SYMMETRIES AND SELECTION RULES FOR WEAK INTERACTIONS. L. A. Radicati (Universita, Pisa, Italy) and D. Speiser. Nuovo cimento (10), 24: 385-91(May 1, 1962). (In English)

Weak interaction selection rules are used to discriminate between different global symmetry schemes. It is postulated that weak interaction selection rules are connected through a discrete group, associated to the global symmetry group. A given set of selection rules is examined; SU_3 and G_2 are compatible with the postulate, whereas B_2 and D_2 are not. (auth)

21299 PARTIAL WAVE DISPERSION RELATIONS IN $\bar{K}$–NUCLEON ABSORPTION. [PART] II. J. Cumming and R. G. Moorhouse (Glasgow Univ.). Nuovo cimento (10), 24: 392-404(May 1, 1962). (In English)

K-nucleon scattering and absorption is investigated at low energies using partial-wave dispersion relations for cases where Σ and Λ have the same or opposite parity. For opposite parity, the experimental results are fitted using the Born approximation singularities only, and the coupling constants are evaluated. (auth)

21300 RELATIVE $\Sigma\Lambda$ PARITY-SPIN OF K MESON AND ASSOCIATED PRODUCTION OF Λ^0K^0. M. Gourdin (European Organization for Nuclear Research, Geneva) and M. Rimpault. Nuovo cimento (10), 24: 414-24(May 1, 1962). (In French)

A phenomenological isobaric model was proposed to calculate the associated production amplitude of strange particles (M. Gourdin and M. Rimpault, Nuovo cimento, 20: 1166(1961)). A comparison with experiment in the case of Λ^0K^0 production is presented. An agreement with experiment for total and differential cross sections can be found for odd $\Sigma\Lambda$ parity, spin of $K^* = 1$; and even $\Sigma\Lambda$ parity spin of $K^* = 0$. The coupling constants corresponding to the Born and isobaric terms are given for both cases. (auth)

21301 ELECTROMAGNETIC PROPERTIES OF UNSTABLE PARTICLES. J. S. Bell (European Organization for Nuclear Research, Geneva). Nuovo cimento (10), 24: 452-60(May 1, 1962). (In English)

Charge and current distributions are defined for unstable particles in no-recoil theories. They are in general complex, and oscillate with amplitudes increasing exponentially at large distances. Moments can be defined. As with stable particles, electric dipole moments are necessarily zero if time reversibility holds. (auth)

21302 SYMMETRIES OF STRONG INTERACTIONS AND ELECTROMAGNETIC FORM FACTORS. H. Ruegg (Université, Geneva). Nuovo cimento (10), 24: 461-6(May 1, 1962). (In English)

If strong interactions are invariant under the simple Lie groups of rank two G_2 or C_2, the electromagnetic form factors of neutral particles are zero. This is true if the particles belong to not too high-dimensional representations of G_2 or C_2. (auth)

21303 POSSIBLE MECHANISM OF VERY HIGH-ENERGY RESONANCES. K. W. Ford (Imperial College, London). Nuovo cimento (10), 24: 467-79(May 1, 1962). (In English)

Examination of the qualitative properties of the spectral expansions of inverse propagators for scalar, spinor, and vector fields suggests that for some or all of these fields there should exist a very heavy quasi-stable particle with the same quantum numbers as the normal physical particle. Self-consistency of field theory and the finiteness of some renormalization constants are assumed. Particles of about 10^2 proton masses might account for observed peculiarities of cosmic ray jets at about 10^5 Bev. Use of the high energy limits of propagators to define bare masses is also suggested. (auth)

21304 MANY-BODY POTENTIALS IN THE LEE MODEL. [PART] II. L. M. Scarfone (Florida State Univ., Tallahassee). Nuovo cimento (10), 24: 480-96(May 1, 1962). (In English)

The energy eigenvalue problem for the bound states of the V-nN sectors ($n \geq 0$) of the Lee model is reduced to a single equation involving the energy, particle separations, parity, and the renormalized coupling constant. The only functions of these quantities that arise in this n + 1-body equation are those characteristic of the one (V) and two (V-N) particle sectors for the case in which there are two real solutions in the one-particle system. An investigation of the n = 3 case shows that it is possible to analyze the corresponding equation, for special geometric configurations, along the lines developed in the two and three (V-2N) particle sectors. If the particle separations form a regular tetrahedron, the eigenvalue equation factors into four possibilities, three of which are identical with the even parity V-N equations with the same separation, and the fourth is similar to the odd parity V-N equation. The equilateral n = 2 case and the n = 3 case admit a multiplicity of the even parity V-N equation equal to the number of N-particles present. It is shown for these symmetrical configurations that two, three and four-body potential energies

can coincide for even and odd parity states, and the critical constant for the appearance of complex energies in the four-body case can be smaller or larger than the corresponding quantities in the two and three-body sectors if the separations involved in the comparisons are chosen appropriately. (auth)

21305 THE UNITARY SYMMETRY AND A CONNECTION BETWEEN THE $|\Delta S| \neq \frac{1}{2}$ AND $|\Delta I| = 2$ RULES. B. d'Espagnat and J. Prentki (European Organization for Nuclear Research, Geneva). Nuovo cimento (10), 24: 497-507(May 1, 1962). (In English)

The assumption is made that weak interactions are invariant under a three-dimensional rotation subgroup G of SU_3, which is not the isospin subgroup. For non-leptonic and leptonic decays, the rule $|\Delta I| = \frac{1}{2}$ follows from the requirement $|\Delta S| \neq 2$ and vice-versa. In such a theory, these selection rules are equivalent. (auth)

21306 THE MAXIMUM ANALYTICITY PRINCIPLE IN THE ANGULAR MOMENTUM. E. Predazzi and T. Regge (Università, Turin and Istituto Nazionale di Fisica Nucleare, Turin). Nuovo cimento (10), 24: 518-33(May 1, 1962). (In English)

It was proposed to extend the maximum analyticity principle to angular momentum. Analyticity of the scattering amplitude in the angular momentum l was proved for potential scattering only when $\mathrm{Re}(l) > -\frac{1}{2}$. It should be possible to extend this analyticity in the whole l plane, apart from those singularities which have a clear physical interpretation in terms of dynamical resonances or bound states. A potential with a strongly repulsive core is possible in the sense that the resulting amplitude is then even in $(l + \frac{1}{2})$ and the desired analytical continuation is then trivial. (auth)

21307 AXIOMATIC DISPERSION RELATIONS AND ANOMALOUS THRESHOLDS. A. Minguzzi (Università, Bologna) and L. Taffara. Nuovo cimento (10), 24: 534-9 (May 1, 1962). (In English)

The condition under which the dispersion relations can be proved in the axiomatic formulation is interpreted as the condition that to fourth order graphs compatible with the spectral conditions, there corresponds a dispersion relation with normal threshold. A justification is given to the limitations on the momentum transfer for which dispersion relations can be proved in non-exothermic cases. (auth)

21308 MESON-NUCLEON INTERACTION IN THE $(10^{10} \div 10^{12})$ ev ENERGY RANGE. P. L. Jain (Univ. of Buffalo). Nuovo cimento (10), 24: 565-84(May 16, 1962). (In English)

Twenty-nine charged and ten neutral secondary interactions with dip angle $< 17°$ are located in nuclear emulsion by scanning the inner cone of the primary interaction of charged and neutral jets of energy $\sim 10^{12}$ ev per nucleon. The angular distributions of the shower particles of these secondary events are presented. The angular distributions of these secondary events are transferred into a system in which they are roughly symmetric. The measurements made include the energy determination of the secondaries, the multiplicities of the showers, the inelasticity of the collision, anisotropy, slopes of Duller and Walker diagrams, and characteristics of the angular distribution in the center of mass system. Analysis of individual and composite events shows that the angular distribution of the shower particles for charged and neutral secondaries at an energy range of 10^{10} to 10^{12} ev is anisotropic in the center-of-mass system (c.m.s.), the anisotropy increasing with the increase of energy. The analysis of individual and composite events also shows that the angular distribution in the c.m.s. of the shower particles of charged secondary events is given by a "two-center" model for all values of the anisotropy parameter $\sigma \geq 0.40$; whereas in the case of neutral secondaries the angular distribution is also given by a "two-center" model, but perhaps for events with a slightly higher value of σ than shown by charged secondaries. (auth)

21309 OPTIMAL K^--p SCATTERING CONDITIONS FOR RESOLVING DALITZ' (a+) AND (a−) SOLUTIONS. Matts Roos (Univ. of Stockholm). Nuovo cimento (10), 24: 657-65(May 16, 1962). (In English)

It is shown that Dalitz' (a+) and (a−) solutions can be resolved, by an elastic K^--p scattering experiment performed in an optimal way. If the lowest measurable K^- meson laboratory momentum is 53 Mev/c and the shortest measurable recoil proton track length is 5 μm, the optimum conditions are met when only events with a K^- scattering angle of 30° or less but with momenta up to the limit of pure s-wave scattering angle are counted. (auth)

21310 CONNECTION BETWEEN DISPLACEMENT OPERATORS AND INTEGRALS OF MOTION FOR PHOTONS. R. H. Good, Jr. (Inst. for Advanced Study, Princeton, N. J.). Nuovo cimento (10), 24: 713-18(May 16, 1962). (In English)

It is shown that the energy, momentum, and angular momentum in the electromagnetic field may be written as a certain type of double integral involving the fields and the displacement operators of the corresponding transformations. The quantity that corresponds to the identity transformation is found to be the excess of right-hand over left-hand polarized photons. It is shown that the uncertainty principle applies for a photon packet provided that energy-weighted averages of position and momentum are used. (auth)

21311 MEASUREMENT OF THE POLARIZATION OF THE RECOIL PROTON IN $\gamma + p \rightarrow p + \pi^0$ USING A PROPANE–ETHANE BUBBLE CHAMBER. L. Bertanza (Università, Pisa, Italy), I. Mannelli, S. Santucci, and G. V. Silvestrini, and V. Z. Peterson. Nuovo cimento (10), 24: 734-45(May 16, 1962). (In English)

The polarization (P) of the recoil proton in $\gamma + p \rightarrow p + \pi^0$ is measured at photon energies (k) of 725 and 900 Mev for center-of-mass angles near 90° using a small propane-ethane gas bubble chamber. Protons emerging from a liquid hydrogen target are momentum-analyzed with a magnet, and the scattering from carbon observed in the bubble chamber. A counter telescope rejects pions and electrons, and protons from multiple pion processes are discriminated against by keeping the peak bremsstrahlung energy just above the mean photon energy. The visual method of observing scattering asymmetries has the advantage of being insensitive to systematic asymmetries in the incoming proton flux. It also quickly eliminates strongly inelastic scatters (stars), and provides a complete angular distribution from which the fraction of inelastic scatters can be deduced. The effect of inelastic scatters upon the scattering asymmetry is large when the energy-loss resolution is poor, an inherent problem with bremsstrahlung beams. The counting rate for this small chamber (3.4 g/cm^2 carbon scatterer) is 11 scatters/hour using every 5th synchrotron pulse. Results are given for k = 725 Mev and ϑ (pion) = 87° (c.m.) (P = 0.74 ± 0.20); and for k = 900 Mev and ϑ (pion) = 70° (P = .51 ± .7). P is taken to be positive along the direction K × p, where p is the momentum of the outgoing proton. (auth)

21312 SCATTERING OF A PARTICLE BY A SYSTEM OF IDENTICAL PARTICLES IN A BOUND STATE. E. Corinaldesi (Inst. for Advanced Study, Princeton, N. J.). Nuovo cimento (10), 24: 757-60(May 16, 1962). (In English)

The interaction Hamiltonians, scattering equations, and first-Born-approximation transition matrix elements are given for interactions of free particles with systems of identical bound particles (e.g., electron scattering by an atom with $Z > 1$). (T.F.H.)

21313 SOME REMARKS ABOUT THE VALIDITY OF THE ROSENBLUTH FORMULA. H. F. Schopper (Technische Hochschule und des Kernforschungszentrums, Karlsruhe, Ger.). Nuovo cimento (10), 24: 761-2(May 16, 1962).

The Rosenbluth formula for proton-electron interactions, relating the electric and magnetic form factors G_E and G_M respectively, the electron scattering angle (Θ), and the electron recoil momentum (q), is studied. It is shown that the Rosenbluth factor R is linear with $\tan^2 \Theta/2$ for fixed G's and q, and that the slope (S) of this line has an upper limit, which is achieved for $G_E = 0$. It is found that for q > about 30 fermi^{-1} and Θ between about 90 and 145°, the experimental data require a value of S that is larger than the calculated upper limit. In this angle and recoil-momentum range, then, the Rosenbluth formula breaks down. (T.F.H.)

21314 AN UPPER LIMIT TO THE ELECTRIC DIPOLE MOMENT OF PHOTONS. N. A. Dyson and J. H. Fremlin (Univ. of Birmingham, Eng.). Phil. Mag. (8), 7: 17-21(Jan. 1962).

Two experiments are described which set upper limits to the longitudinal electric dipole moment of photons emitted in radioactive decay. The Mössbauer effect enables small changes of energy, which might result from the interaction between the photons and a varying electric field, to be looked for and the 14.4 kev transition in iron-57 was used for this purpose. Two possible types of interaction are considered and, depending upon which approach is used, upper limits of 1.0×10^{-20} and 1.1×10^{-19} esu (95% probability) are established. (auth)

21315 INTERNALLY PRODUCED ELECTRON PAIRS FROM π^--MESONS CAPTURED IN HYDROGEN. D. C. Cundy, R. A. Donald, W. H. Evans, D. W. Hadley, W. Hart, P. Mason, R. W. Newport, D. E. Plane, J. R. Smith, and J. G. Thomas (Univ. of Liverpool). Phil. Mag. (8), 7: 121-6(Jan. 1962).

Internal pairs produced by π^--mesons captured in hydrogen were studied with a hydrogen bubble chamber. The probability that a stopped meson produces a pair was found to be 0.0093 ± 0.0006. This probability, which is very insensitive to the Panofsky ratio, serves to check the theoretically predicted values of the conversion coefficients of Joseph. (auth)

21316 THE RADIATION OF ELECTROMAGNETIC WAVES AND THE INSTABILITY OF ELECTRONS MOVING AT SUPER-LIGHT VELOCITY IN A MEDIUM. V. L. Ginzburg, V. V. Zheleznyakov, and V. Ya. Eidman (Lebedev Inst. of Physics, Moscow). Phil. Mag. (8), 7: 451-8(Mar. 1962).

The features of the radiation of electromagnetic waves by particles or systems (atoms, molecules, etc.) moving in a medium or near a medium (the moderating system) at super-light velocity can often be successfully analyzed by applying quantum considerations, even when the problem is a classical one. This is also the case for the radiation, absorption, and amplification of waves in beams of particles, and for the study of their instability. Considerations of this kind are discussed, including the problem of the classical force of reaction of the radiation when a charge moves in a medium. The basic result, which follows from both simple quantum considerations and classical calculations, is as follows: when the motion is at super-light velocity, the radiation reaction force which changes the amplitude of oscillation of a particle decreases, and in some cases even changes sign, i.e., responds to the building up of oscillations and not to friction. In accordance with this fact, when beams of particles are moving in a medium at super-light velocity they become unstable, and the electromagnetic waves are amplified. (auth)

21317 A REACTION FORBIDDEN BY THE SAKATA MODEL OF UNITARY SYMMETRY. C. A. Levinson (Weizmann Inst. of Science, Rehovoth, Israel), H. J. Lipkin, S. Meshkov, A. Salam, and R. Munir. Phys. Letters, 1: 125(May 15, 1962). (In English)

It is shown that the reaction $p + \bar{p} \rightarrow K_1^0 + K_2^0$ is strictly forbidden according to the Sakata model of unitary symmetry. Experimental observations are thus interpreted as evidence against the Sakata model. (L.N.N.)

21318 QUANTUM NUMBERS OF A NEUTRAL PARTICLE DECAYING INTO $(\pi^+\pi^-\pi^0)$. A. Stajano (Università, Rome) and B. Vitale. Phys. Letters, 1: 127-9(May 15, 1962). (In English)

A weak selection rule is defined. Consequences limiting the number of possible assignments of quantum numbers to mesons (η^0) and (ω^0) for conserved and non-conserved G parity are discussed in the light of experimental evidence concerning charge states of these particles. (L.N.N.)

21319 FOUR PION WAVE FUNCTIONS. M. Grynberg and Z. Koba (Inst. for Nuclear Research, Warsaw). Phys. Letters, 1: 130-2(May 15, 1962). (In English)

Using previously published procedures (Z. Koba, Physics Letters, 1: 34(1962)) orthonormal wave functions were derived for systems of four free pions satisfying Bose statistics and possessing definite values of total angular momentum, parity in the center-of-mass system, and a definite total isospin. (L.N.N.)

21320 A NOTE ON MUON PARITY. C. Ryan (University Coll., Dublin and Dublin Inst. for Advanced Studies). Phys. Letters, 1: 135(May 15, 1962). (In English)

If isoparity rather than hypercharge is the basic physical quantity, the law of conservation of strangeness in strong interactions is $\Delta S = 4n$, where n is any integer, rather than $\Delta S = 0$. Whereas strangeness is an additive quantum number, isoparity is multiplicative. The relation between muon conservation and strangeness conservation is discussed. (L.N.N.)

21321 CHECK OF THE CONSERVED VECTOR CURRENT HYPOTHESIS. A. F. Dunaitsev, V. I. Petrukhin, Yu. D. Prokoshkin, and V. I. Rykalin (Joint Inst. for Nuclear Research, Dubna, USSR). Phys. Letters, 1: 138-40 (May 15, 1962). (In English)

The probability value of the reaction $\pi^+ \rightarrow \pi^0 + e^+ + \nu$ was determined; $\lambda = (1.1^{+1.5}_{-0.5}) \times 10^{-8}$ was obtained. Results support the validity of the conserved current hypothesis. (L.N.N.)

21322 A NOTE ON THE $_\Lambda He^7$ HYPERFRAGMENTS. J. Pniewski and M. Danysz (Univ. of Warsaw and Inst. of Nuclear Research, Warsaw). Phys. Letters, 1: 142-4 (May 15, 1962). (In English)

Experimental results from recent publication on $_\Lambda He^7$ decays show a wide spread of B_Λ values. A tabulation of these values led to their separation into two groups with average values $B'_\Lambda = (5.1 \pm 0.4)$ Mev and $B''_\Lambda = (3.2 \pm 0.4)$ Mev. The existence of an isomeric state in the hyperfragment that would justify the two B_Λ values is then discussed. (L.N.N.)

21323 POLARIZATION IN π^--p SCATTERING BETWEEN 500 AND 940 Mev. E. F. Beall (Univ. of California, Berkeley), B. Cork, P. G. Murphy, W. A. Wenzel, C. M. P. Johnson, and L. J. Koester, Jr. Phys. Rev., 126: 1554-60(May 15, 1962).

A graphite-plate spark chamber has been used to analyze the polarization of protons recoiling from π^--p scattering. The observations were made at 90° (cm system) pion scattering angle for seven incident pion energies between 500 and 940 Mev, at 120° or 135° for five energies in this interval, and also at 75° for 500 Mev only. The results are compared with predictions of several models used to explain the maxima in the π^--p scattering cross section. Qualitative arguments show that the energy intervals between these maxima are not completely dominated by neighboring single-state resonances. Phase shifts found to be large in scattering also seem to be large in polarization. (auth)

21324 CONNECTION BETWEEN GAUGE INVARIANCE AND MASS. David G. Boulware and Walter Gilbert (Harvard Univ., Cambridge, Mass.). Phys. Rev., 126: 1563-7 (May 15, 1962).

The limit, as the bare mass vanishes, of a theory of a massive neutral vector meson interacting with charged fields is investigated. A redefinition of the charged-field operators is exhibited so that the original theory, involving a positive definite metric, goes over smoothly to a radiation gage theory. The spectral forms for the boson two-point function are exhibited to show that the limit to a gage-invariant theory does not restrict the interacting mass of the vector particle. A soluble example is given in which these limits can be studied in detail and in which the gage-invariant limit describes a massive vector particle. (auth)

21325 μ CAPTURE WITH SIX NUCLEON FORM FACTORS. J. Barclay Adams (Univ. of California, Berkeley). Phys. Rev., 126: 1567-71(May 15, 1962). (UCRL-9864 and Rev.)

The matrix element for μ capture ($\mu^- + p \rightarrow n + \nu$) including not only the effects of vector, axial-vector, weak-magnetism, and induced-pseudoscalar couplings but also two "second-class" couplings has a small dependency on these hitherto undetected couplings. Capture in μ-mesonic hydrogen from the S states with both $F = 1$ and $F = 0$ is computed, and angular distributions of recoil neutrons and capture rates are given as functions of the six coupling constants. It is found that the second-class terms may contribute fully as much as weak-magnetism and induced-pseudoscalar terms. (auth)

21326 RESONANCE-INTERFERENCE METHOD FOR DETERMINING KΣN PARITY. Richard H. Capps (Northwestern Univ., Evanston, Ill.). Phys. Rev., 126: 1574-80 (May 15, 1962).

A method is given for determining the orbital parity of the $\pi + \Sigma$ state of the 1520-Mev, strangeness (−1), resonance by measuring angular distributions and hyperon polarizations resulting from the process $K^- + p \rightarrow \pi + \Sigma$. The method depends on the observation of interference between the resonance state and at least one other state, and on the assumption that the relative phase of the resonant and nonresonant state increases with energy. The validity of this assumption is discussed. Since the orbital parity of the $K^- + p$ state may be determined by continuing the measurements from the resonance energy down to the $K^- + p$ threshold energy, this method may yield the intrinsic KΣN parity. The various ambiguities in the determination of partial wave amplitudes from experimental data are discussed. It is shown that the many-channel unitarity condition may be useful in resolving some of the ambiguities. (auth)

21327 AN EXTENSIBLE MODEL OF THE ELECTRON. P. A. M. Dirac (Univ. of Cambridge, Eng.). Proc. Roy. Soc. (London), A268: 57-67(June 19, 1962).

It is proposed that the electron should be considered classically as a charged conducting surface, with a surface tension to prevent it from flying apart under the repulsive forces of the charge. Such an electron has a state of stable equilibrium with spherical symmetry, and if disturbed its shape and size oscillate. The equations of motion are deduced from an action principle and a Hamiltonian formalism is obtained. The energy of the first excited state with spherical symmetry is worked out according to the Bohr–Sommerfeld method of quantization, and is found to be about 53 times the rest-energy of the electron. It is suggested that this first excited state may be considered as a muon. The theory presented ignores electron spin, so it cannot agree accurately with experiment. (auth)

21328 INCORPORATION OF ERROR FUNCTION ABSORPTION COEFFICIENT IN TRANSPORT EQUATION. Jin H. Chin and Stuart W. Churchill (Univ. of Michigan, Ann Arbor). Quart. Appl. Math., 18: 93-6(Apr. 1960).

The error function absorption coefficient and its relation to the true spectral coefficient for radiation absorption are discussed. The way in which the error function absorption coefficient can be incorporated in a solution of the transport equation which describes radiative transfer is demonstrated. (M.C.G.)

21329 S-MATRIX THEORY OF STRONG INTERACTIONS. A Lecture Note and Reprint Volume. Geoffrey F. Chew. Frontiers in Physics. A Lecture Note and Reprint Series. New York, W. A. Benjamin, Inc., 1961. 92p.

An elaboration of lecture notes on S-matrix theory is presented, with particular attention to the role of the double spectral function. Studies of the pion-pion and pion-nucleon interactions, and of pion and nucleon electromagnetic structures, are also reviewed. Reprints of articles concerning analytic properties of vertex parts in quantum field theory, Feynman and scattering amplitudes, the Mandelstam representation, dispersion relations, and potential scattering are included. (T.F.H.)

Neutron Physics

21330 (AD-267646) THE DETERMINATION OF THE GEOMETRIC BUCKLING OF A CYLINDRICAL ASSEMBLY WITH CONCENTRIC VOIDS BY THE PULSED NEUTRON METHOD (thesis). Jerry Albert Sawyer (North Carolina State Coll., Raleigh). 1961. 93p.

The effect of concentric cylindrical voids on the geometric buckling for a finite cylindrical assembly was measured using the pulsed neutron technique. A 1 Mev Van de Graaf accelerator supplied bursts of neutrons to ordinary distilled water at 28°C contained in an Al cylinder with an inside diameter of 11.946 in. and a height of 12.52 in. With the water height maintained constant at 10.88 in., voids with a constant outer radius of 3.46 in. were formed in incremental thicknesses of 0.5 in. up to a maximum gap width of 2 in. The buckling of the assembly was calculated from the measured neutron lifetimes with diffusion parameters obtained by Epling (M.S. Thesis, North Carolina State College, 1960). Agreement of theory with experiment was good for small void thicknesses. For gap widths of 1.5 in. and greater the observed buckling was larger than that calculated due to the axial streaming present for finite cylinders. (auth)

21331 (AERE-R-4019) PROGRESS OF THE SCATTERING LAW EXPERIMENT. P. A. Egelstaff (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England). Aug. 18, 1959. Reprinted Apr. 1962. 15p. (TNCC(UK)-47; TNCC(CAN)-18).

The general survey of neutron scattering from D_2O, H_2O, and graphite was completed. The measured scattering laws are shown. (M.C.G.)

21332 (AERE-R-4041) THE SCATTERING OF THERMAL NEUTRONS BY MODERATORS (REVISED). P. A. Egelstaff (United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England). Apr. 1962. 23p.

A comprehensive scheme for the analysis and use of thermal neutron scattering data is described. Experimental work was carried out with a 4-rotor high speed chopper system operated in conjunction with a multi-counter multichannel neutron time-of-flight system. This apparatus allows many probability measurements to be made of incident neutrons of specified energy to be scattered through known angles with known energy changes. The results of such experiments are reduced to a "Scattering Law," which is a function S of two variables (α and β) representing the momentum and energy transferred in the scattering process. Scattering Laws were measured for many moderators at many temperatures. In estimating the accuracy to which measurements, analysis and calculations of the scattering law need be done, it is necessary to evaluate a "sensitivity function" for each neutron spectrum problem, and thus for each scattering law a variety of sensitivity functions must be evaluated. Two simple examples are discussed which show, separately, the effect of absorption and temperature gradients. (auth)

21333 (CRRP-1078) THE CHALK RIVER THERMAL NEUTRON ANALYSER. P. A. Egelstaff, S. J. Cocking, and T. K. Alexander (Atomic Energy of Canada Ltd., Chalk River, Ont.). Oct. 1960. 29p. (AECL-1494)

An instrument is described which selects pulses of near monokinetic neutrons from a beam from the NRU reactor. The velocity distribution of the neutrons after scattering is simultaneously measured by time-of-flight methods in several detectors at different angles of scatter. Details are given of the use of four rotors spinning in fixed phase relationships to one another; two rotors are phased to remove the fast neutrons from the beam while two other rotors select a narrow velocity band of slow neutrons. Using several differently curved rotor slots and rotational speeds in the range 24,000 rpm to 36,000 rpm, neutrons in the energy range 0.03 and 0.15 ev were selected with velocity spread less than 1%. The use of tape recording techniques to provide simultaneously 270 timing channels for many (up to 30) detectors for scattered neutrons is given. Following the detailed description of the components of the instrument, figures are given for count rates, background rates, and resolution achieved. Presentation of results in terms of the "scattering law" is described and illustrative results are given for scattering by vanadium and water. The method of deriving the "scattering kernel" in illustration of the application to reactor spectrum calculation is also given. (auth)

21334 (DC-60-12-98) BERYLLIUM NEUTRON CROSS SECTIONS. T. J. Kostigen (General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati). Dec. 13, 1960. Contract AT(11-1)-171. 20p.

Microscopic, group averaged cross sections and scatter-transfer cross sections for beryllium are presented in a 24 group format. (auth)

21335 (XDC-60-2-76) MODIFIED FAST NEUTRON ATTENUATION FUNCTIONS. A. W. Casper (General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati). Feb. 3, 1960. Contract AT(11-1)-171. 25p.

Coefficients were determined for the Albert and Welton fast neutron attenuation function by constraining it to pass through three experimental data points. These coefficients, suggested for use in making fast neutron dose rate calculations in hydrogenous materials, are: $\alpha_1 = 1.5964 \times 10^3$, $\alpha_2 = 0.34921$, $\alpha_3 = 0.42231$, and $\alpha_4 = 0.69842$. Coefficients of the polynomial exponent in the following hydrogen attenuation function were determined by constraining the function to pass through four experimental data points: $\Psi(X) = e^{20.523-0.0941X+0.000014374X^2+0.0000008443X^3}$. Both functions give dose rates in millirep per hour per watt. A careful study was made of computations using these functions and better results were obtained in all cases studied. (auth)

21336 THE YVON APPROXIMATION METHOD. [PART II]. H. Kellner (Österreichische Hochschule, Vienna). Atomkernenergie, 7: 92-4(Mar. 1962). (In German)

The asymptotic solution in the case of no absorption is used to derive Fick's law of diffusion. The boundary conditions are discussed generally. The Milne-problem is solved for the angular distribution, the flux, and the current. Finally, a comparison is carried out with the method of Sykes. (auth)

21337 PENETRATION EFFECT OF FAST NEUTRONS IN MODERATORS. Chi-peng Chien (National Tsing Hua Univ., Taipei, Japan). Ho Tsu K'o Hseuh, 3: No. 2, 14-24 (1961). (In Chinese)

The position and intensities of maximum slowing down density and thermal flux shown by fast neutrons after penetrating a moderator containing compounds of hydrogen, e.g., H_2O, D_2O are essential studies in the design of shielding from secondary gamma radiation. A theoretical study is made of these effects by the method of image. Detailed calculations and tabulations of values are given. An attempt is made to apply the theory to water, in which, Fermi's age theory is a poor approximation. The chemical binding effect of hydrogen and oxygen are considered in these calculations. The "age" values are modified. (TTT)

21338 SPECTRAL ANALYSIS OF FAST NEUTRONS IN A NATURAL URANIUM BLOCK. C. Beets (Centre d'Etude de l'Energie Nucleaire, Mol, Belgium), J. L. Campan, H. Deckers, and C. P. Zaleski. J. Nuclear Energy, Pts. A & B, Reactor Sci. and Technol., 16: 221-5(Apr. 1962). (In French)

The fast neutron spectrum induced by thermal neutrons in a natural uranium block is measured by means of two techniques, viz. fission chambers and nuclear emulsions. The responses of both detectors are compared with the asymptotic spectrum calculated from 20-group constants. (auth)

21339 NOTE ON CALIBRATION OF THE NBS STANDARD THERMAL NEUTRON DENSITY. J. A. DeJuren (Atomics International, Canoga Park, Calif.). J. Nuclear Energy, Pts. A & B. Reactor Sci. and Technol., 16: 235 (Apr. 1962).

Accepting the value of the thermal neutron activation cross section of Mn as 13.16 ± 0.11 barn, a recalibration of the neutron flux of the NBS standard apparatus is carried out. (T.F.H.)

21340 RESONANCE ABSORPTION AND NON-UNIFORM TEMPERATURE DISTRIBUTIONS. G. Rowlands (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Nuclear Energy, Pts. A & B. Reactor Sci. and Technol., 16: 235-6(Apr. 1962). (AERE-M-717).

The resonance absorption of neutrons by bodies having complicated shapes and nonuniform temperature distributions is studied. An effective temperature T is defined for the body as a function of the actual temperature distribution, the neutron flux distribution, and the shape of the body. The resonance absorption is then found to be the same as that for a body having the actual shape but temperature T. The results of this treatment are shown for slabs, spheres, and cylinders having parabolic temperature distributions. It is assumed throughout that scattering processes can be ignored. (T.F.H.)

21341 THE NUMERICAL SOLUTION OF TWO-GROUP DIFFUSION EQUATIONS FOR STATIONARY SYSTEMS WITH DIGITAL COMPUTERS. W. Bergmann (Zentralinstitut für Kernphysik, Rossendorf, Ger.). Kernenergie, 5: 83-9(Feb. 1962). (In German)

The optimum programming in the solution of two-group equations with digital computers is considered. Arrangements in cylindrical or spherical geometry with randomly placed axially symmetrical or spherically symmetrical layers are discussed, and storage requirements and calculation times with the programs developed for the ZRA-1 and D 1-2 computers are given. This "one-dimensional" investigation is applied to theoretical expressions with respect to the "numerical expenditure" on the corresponding two-dimensional problem in cylindrical problems in which a direction dependence of the cylinder axis was considered. Storage balances and calculation time estimates result which permit a determination of the computer capacity to be assumed when eight two-dimensional calculations in boundary value eigenvalue problems are undertaken. (tr-auth)

21342 NEW CONSTANTS FOR AN APPROXIMATION FUNCTION FOR THE NEUTRON SCATTERING CROSS SECTION OF WATER. Th. Wendnagel (Technische Hochschule, Stuttgart). Nukleonik, 4: 79-81(Mar. 1962). (In German)

An approximation formula given by H. D. Brown for the scattering cross section of water molecules for thermal neutrons can be adapted to energy regions of higher particle densities by determination of new values for the constant. The approximation formula can then be used in a calculation of the transport path length of thermal neutrons. The uncertainties occurring as a result of not adapting the approximation functions can be reduced from 15% to about 1%. (tr-auth)

21343 CALCULATION OF THE ANGULAR DISTRIBUTION IN THE SCATTERING OF SLOW NEUTRONS ON WATER. E. Kiefhaber (Kernforschungszentrums, Karlsruhe, Ger.). Nukleonik, 4: 82-91(Mar. 1962). (In German)

The angular distribution obtained by the simple scattering of monoenergetic neutrons on light water was calculated with the help of differential scattering cross sections derived by M. S. Nelkin by numerical integration over the final energy. The results are compared with the corresponding experimental results of C. Reinsch and T. Springer. At small scattering angles, the integration can be carried out analytically under fixed assumptions. The mean cosine of the scattering angle and the transport path length of liquid water were calculated. (tr-auth)

21344 MONOENERGETIC TREATMENT OF THE NEUTRON TRANSPORT PROBLEM IN FUEL SAMPLES AND WIGNER-SEITZ CELLS. H. Kuesters and K. Ott (Kernforschungszentrums, Karlsruhe, Ger.). Nukleonik, 4: 91-7(Mar. 1962). (In German)

The high accuracy of the calculation of the neutron flux in fuel elements cannot be completely utilized when the inlet current was calculated according to the diffusion theory from the gradients of the neutron flux at the rod boundary. The inlet current is calculated from the rigid transport theory integral. The neutron flux in the moderator is described by an improved diffusion solution. The curvature at the boundary of the Wigner-Seitz cells is proved by direct numerical integration of the Boltzmann equation. The method is applied to plane and spherically symmetrical problems. (J.S.R.)

Nuclear Properties and Reactions

Refer also to abstract 20302.

21345 (AEET/HP/4) RADIOACTIVE EQUILIBRIUM. D. V. Gopinath and V. K. Sundaram (India. Atomic Energy Establishment, Trombay). 1961. 16p.

Expressions are derived for the time of maximum activity and time of fractional maximum activity for the second member of a radioactive chain in different cases viz., natural radioactivity and induced activity in continuous and cyclic irradiations. Behavior of daughter activity after the time of maximum activity for different ratios of the half lives is discussed. Some universal curves that are useful in activity buildup calculations are presented. (auth)

21346 (ARL-185) THE ENERGY DISTRIBUTION OF ELECTRONS FROM IONIZING COLLISIONS OF HEAVY PARTICLES. Final Report, June 1958 to August 31, 1961. H. W. Berry (Syracuse Univ., N. Y.). Dec. 1961. Contract AF 33(616)-5741. 79p.

The energy distributions of electrons ejected in ionizing collisions of rare gas ions and atoms were measured for incident particle energies of 0.30 to 3.0 kev. Similar measurements were also made for ions, fast atoms or molecules of N and H. For the rare gases, the distribution seems to be composed of a continuous spectrum which has its largest value at the zero of electron self-energy followed by a rapid decrease, another consists of a number of limited energy range electron groups which, in yield and in mean energy, are characteristic of the colliding particles. The relative importance of the two parts varies widely with the particles involved. For the molecular gases, only a continuous spectrum is found. A mechanism in which the characteristic electrons are produced by a radiationless transition (autoionization) is discussed, and for some cases the electron energies are related to particular excitations of the particles involved. (auth)

21347 (AWRE-0-58/61) LIGHT MASS YIELDS IN THE 14 Mev NEUTRON FISSION OF U-235. D. G. Vallis and A. O. Thomas (United Kingdom Atomic Energy Authority. Weapons Group. Atomic Weapons Research Establishment, Aldermaston, Berks, England). Jan. 1962. 19p.

By irradiating targets of highly enriched U^{235} with 14.7 Mev neutrons produced by the D,T reaction in the Aldermaston Cockcroft-Walton accelerator, the fission yields of Br^{82}, Br^{83}, Br^{84}, Se^{81m}, As^{77}, Ga^{73}, Zn^{72}, and Ni^{65} were determined relative to that of Mo^{99}. A determination of the absolute fission yield of Mo^{99} was made under the same experimental conditions by irradiating mixtures of iron and U^{235} solutions followed by measurement of the activities of Mo^{99} and Mn^{54} produced by fission and (n,p)

reaction respectively. A value of 5.2 ± 0.5% was obtained in good agreement with the previously published figure of 5.17%. (auth)

21348 (IFA/FT/40) TABLES OF CLEBSCH–GORDAN COEFFICIENTS. A. Sandulescu and M. Stihi (Academia R. P. R. Institutul de Fizică Atomică, Bucharest). 1962. 6p.

21349 (IDO-16698) TABULATION OF THE Pa^{231} TOTAL NEUTRON CROSS SECTIONS. F. B. Simpson and W. H. Burgus (Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho). Jan. 31, 1962. Contract AT(10-1)-205. 50p.

The total cross section for Pa^{231} was measured from 0.01 ev to 2 kev, with the use of the Materials Testing Reactor fast chopper with resolutions from 0.040 to 2.0 μsec/meter. Curves and tables are presented for the cross section as a function of energy. These measurements were taken with samples prepared from 0.558g of Pa_2O_5. A linear least square fit to the data between 0.015 and 0.03 ev gives a value of 211 ± 2 barns for the thermal cross section. (auth)

21350 (NP-11602) THE ATTENUATION OF THE ANGULAR CORRELATION OF ^{181}Ta 133–482 kev CASCADE IN LIQUIDS. Report No. 155. E. Bozek, A. Z. Hrynkiewicz, Z. Konieczna, S. Ogaza, M. Rybicka, and S. Szymczyk (Polish Academy of Sciences. Inst. of Nuclear Research, Krakow). Jan. 1962. 9p.

The measurements of the time dependence of the angular correlation anisotropy for the 133 to 482 kev γ–γ cascade in Ta^{181} were carried out. An exponential attenuation of the anisotropy was found in the case of Ta ions in concentrated sulfuric acid. The experimental values of the attenuation constant λ_2 for different temperatures are compared with the theory. (auth)

21351 (NP-11651) ANGULAR CORRELATIONS OF NUCLEAR RADIATIONS. R. M. Steffen (Buenos Aires. Universidad. Facultad de Ciencias Exactas, Físicas y Naturales). July 1961. 86p.

An examination of angular correlations of nuclear radiations as an important tool in nuclear spectroscopy is presented. Angular correlation measurements are a basis for determining the static properties of excited nuclear states such as angular momentum, parity, magnetic dipole moments, and electric quadrupole moments. It is noted that higher moments, like octupole magnetic moments may exist, but can be neglected in angular correlations because of weak interaction with external fields. (J.R.D.)

21352 (NP-11667) NEUTRONS PARTIAL CROSS SECTION STUDIES. D. R. Koehler and W. L. Alford (Army Ordnance Missile Command, Redstone Arsenal, Ala.). Apr. 10, 1962. 34p.

The (n,2n) excitation functions are given for Zn^{64}, Br^{79}, Ag^{107}, Sb^{121}, and Pr^{141}. Evidence is presented for a 7+ isomeric state in Y^{90} at 0.685 Mev. $Zr^{90}(n,p)Y^{90m}$ and $Nb^{93}(n,\alpha)Y^{90m}$ cross sections for 14.7-Mev neutrons are reported to be 12 ± 4 mb and 5 ± 2 mb, respectively. (auth)

21353 (NP-11681) A SHELL MODEL ANALYSIS OF THE REACTION $B^{11}(d,n)C^{12}$. Technical Report No. 242. M. A. Nagarajan (Maryland. Univ., College Park). Mar. 1962. 18p.

It was previously concluded that an analysis of a stripping reaction needs the incorporation of exchange effects. A complete shell model analysis of the reaction $B^{11}(d,n)C^{12}$ was made and the relative amplitudes for direct and heavy particle stripping modes obtained. Excellent agreement between theory and experiments was obtained. (auth)

21354 (NP-11682) DEUTERON WIDTHS IN 1p-SHELL NUCLEI. Technical Report 247. M. A. Nagarajan (Maryland. Univ., College Park). Mar. 1962. 17p.

An estimate of the deuteron widths in 1p-shell nuclei was made using harmonic oscillator wave functions for the single nucleon wave functions. The results show that large deuteron widths in light nuclei are not in contradiction to the predictions of the shell model. It is also shown that such large deuteron widths are a direct consequence of the large size of the deuteron. (auth)

21355 (NP-11697) INTERACCIÓN DE DEUTERONES DE 27,0 Mev. CON BLANCOS GASEOSOS DE NITRÓGENO. INFORME NO. 66 (Interaction of 27.0 Mev Deuterons with Target of Nitrogen Gas. Report No. 66). H. J. Erramuspe and R. J. Slobodrian (Argentina. Comisión Nacional de Energía Atómica, Buenos Aires). 1962. 11p.

The angular distributions of protons from the reaction $N^{14}(d,p)N^{15}$ and of the elastically scattered deuterons were measured. The reaction takes place between the ground states of N^{14} and N^{15}, and their spins and parities are known. No appreciable contribution from compound nuclei, exchange, or heavy stripping processes seems to be present in the angular distribution. The value found for the orbital angular momentum implies the spin flip of the outcoming nucleon, using an optical analogy that implies the scattering of waves from a black disk, an interaction radius was calculated for the deuteron-nucleus system of $r_0 = 6.5 \times 10^{-13}$ cm. (J.R.D.)

21356 (NYO-2666) GRAPHS FOR DETERMINING REDUCED WIDTHS IN (d,p) STRIPPING EXPERIMENTS. Technical Report No. 74. H. Y. Chen, H. A. Enge, and H. F. Lutz (Massachusetts Inst. of Tech., Cambridge. Lab for Nuclear Science). Jan. 1962. Contract AT(30-1)-2098. 43p.

Charts are presented for aid in analysis of angular-distribution data from (d,p) reactions. The computations are based on the non-Coulomb Born-approximation formula, and treatment is restricted to cases where the energy level formed in the residual nucleus is a bound state. (M.C.G.)

21357 (RADC-TR-61-132) INVESTIGATION OF COUPLED ELECTRON AND NUCLEAR SPIN SYSTEMS. Alexander Ganssen and Earl Law Sloan, III (National Co., Inc., Malden, Mass.). Mar. 1961. Contract AF 30(602)-2008. 119p. (AD-266071).

A theory is presented which describes the time-dependent nuclear magnetization production obtained by means of the Overhauser effect in low-viscosity liquids containing unpaired electrons in free radicals or paramagnetic ions. An experimental technique is described which allows the simultaneous determination of the nuclear magnetization and of the nuclear spin lattice relaxation time T_1 on a flowing sample. The liquid flowing in a Teflon capillary within a homogeneous magnetic field of about 3300 gauss passes through a microwave cavity, where a partial saturation of the electron spin resonance is accomplished with a comparatively strong microwave field. The dynamic polarization resulting from the coupling with the electron spin system is detected by two nuclear magnetic resonance detection coils equipped with separate detection systems, arranged successively outside of the microwave cavity. The accuracy of the determination of the proton spin lattice relaxation time T_1 with the liquid-flow technique is discussed under special consideration of the flow velocity distribution given by laminar and turbulent flow. (auth)

21358 (SERL-TR-M-61) CALCULATED NEUTRON YIELD FROM TITANIUM–TRITIUM TARGETS UNDER

DEUTERON BOMBARDMENT. E. W. Saker and J. D. L. H. Wood (Gt. Brit. Services Electronics Research Lab., Baldock, Herts, England). Sept. 18, 1958. 11p.

The yield is calculated for targets of TiT_N with atomic N ratios from 0.2 to 2.3 bombarded by atomic and molecular deuterium ions at 8 to 200 kev. (auth)

21359 (TID-15692) THE L AUGER YIELDS OF MERCURY (thesis). William T. Achor (Vanderbilt Univ., Nashville). June 1954. 53p.

A knowledge of L Auger yields is of importance in the study of nuclides which decay by orbital capture. An investigation of the electron spectrum of Au^{199} to determine the L Auger yields of mercury was made with a magnetic spectrometer. The beta spectrum was found to be composed of three components whose end points are 251 ± 10, 302 ± 10, and 460 ± 10 kev. The conversion line spectra indicated the presence of three gamma rays with energies of 49 ± 1, 159 ± 1, and 209 ± 2 kev. Relative conversion coefficients were calculated. The crude total L Auger yield of mercury for the distribution of L vacancies produced by the decay of Au^{199} was found to be 0.629 ± 0.035. An attempt was made to account for the effect of Coster-Kronig transitions in the calculation of L subshell yields, but it was not possible to do this with the data. Crude values of two of the subshell Auger yields were obtained. These were 0.577 ± 0.086 for L_{II} and 0.83 ± 0.12 for L_{III}. (auth)

21360 (UCRL-10125) TOTAL CROSS SECTION OF K^- MESONS ON NUCLEONS IN THE MOMENTUM REGION 630 Mev/c TO 1100 Mev/c (thesis). Maung Tin Maung (California. Univ., Berkeley. Lawrence Radiation Lab.). Mar. 15, 1962. Contract W-7405-Eng-48. 86p.

The total cross sections of K^- mesons in hydrogen and deuterium were measured at 630 to 1100 Mev/c. The K^--n total cross sections were obtained from the hydrogen and deuterium data. These cross sections, with an accuracy of better than 5%, were measured at the Berkeley Bevatron by counter techniques. Two high-resolution velocity-selecting Cherenkov counters were used to select the K^- mesons. The momentum of the K^- beam was measured with a counter telescope and an analyzing magnet. The K^--p and K^--d cross sections were measured at nine and five representative momenta respectively. A well-defined resonance appears in the K^--p total cross section at about 1050 Mev/c K^- momentum (laboratory system). The neutron cross sections do not have enough statistical accuracy to enable us to infer any structure. (auth)

21361 (XDC-60-1-141) ABSORPTION CROSS SECTION OF STABLE, LOW CROSS SECTION FISSION PRODUCTS. S. K. Breslauer (General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati). Dec. 31, 1959. Contract AT(11-1)-171. 10p.

A record of the relatively stable, low cross section fission products available on ANP nuclear data tape is presented for conventional reactor calculations. The record is based on data included in the Geneva conference paper by Gordeev and Pupko. The label slag is applied to fission products. (J.R.D.)

21362 (AEC-tr-5115) ENERGY SPECTRUM OF RESONANCE ABSORPTION OF γ-RADIATION OF 92 Kev Zn^{67} IN ZINC OXIDE. V. P. Alfimenkov, Yu. (Iu.) M. Ostanevich, T. Ruskov, A. V. Strelkov, F. L. Shapiro, and Wu-kuang Yen (Ian' U-guan) (Joint Inst. for Nuclear Research, Dubna, U.S.S.R. Lab. of Neutron Physics). Translated by Helen J. Chick (Los Alamos Scientific Lab., N. Mex.) from report JINR-P-845. 1961. 18p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 16, abstract no. 13946.

21363 (UCRL-Trans-822(L)) QUADRUPOLAR AND DIPOLAR GAMMA RADIATION OF NUCLEI. A. Migdal. Translated by S. Shewchuck (Univ. of California Lawrence Radiation Lab., Livermore) from Zhur. Eksptl'. i Teoret. Fiz., 15: 81-8(1945). 14p.

The order of magnitude of the matrix elements of dipolar and quadrupolar radiation is evaluated, and the reason that the intensity of the corresponding transitions (at about 1 Mev) possesses the same order of magnitude is shown. For energies greater than 1 Mev, the intensity of the dipolar transitions must be much greater than the intensities of the quadrupolar. (J.R.D.)

21364 CALCULATION OF THE OPTICAL POTENTIAL WITH THE NUCLEON-NUCLEON PHASE SHIFTS IN THE THOMAS-FERMI APPROXIMATION. Janusz Dąbrowski (Univ. of Warsaw), Adam Sobiczewski, and Malgorzata Zielińska. Acta Phys. Polon., 21: 145-52(1962). (In English)

The radial dependence of the optical potential for nucleon-nucleus scattering is calculated using the empirical nuclear density. The nucleus is locally approximated by the Fermi model. The equation for scattering in the nuclear medium is solved approximately, and the optical potential is expressed using nucleon-nucleon phase shifts. In the numerical computations, the Signell-Marshak phase shifts are used. The effect of the exclusion principle increases the depth of the real part and decreases the depth of the imaginary part of the optical potential in the center of the nucleus. The radius of the real part is practically equal to the radius of the density distribution, whereas the radius of the imaginary part is slightly larger. Results are compared with experimental estimates of the optical potential. (auth)

21365 A CALCULATION OF THE LEVEL SPECTRUM OF O^{18} FROM THE FREE TWO-NUCLEON POTENTIAL. J. F. Dawson, I. Talmi, and J. D. Walecka (Stanford Univ., Calif.). Ann. Phys. (N. Y.), 18: 339-66(June 1962).

The two-neutron binding energy and excitation spectrum of O^{18} are computed using a free nucleon–nucleon potential that contains a hard core. The problem is discussed within the framework of a theory using harmonic oscillator wave functions as the unperturbed solutions. The interaction is diagonalized among the degenerate states and matrix elements are computed by a transformation to relative and center-of-mass coordinates. The energies in relative s-states are obtained by a numerical integration of the relative s-wave Schrödinger equation and then corrected for the presence of the filled levels. The ordering of the first five states of O^{18} is given correctly and the predicted binding energy and level spacings are quite close to the experimental values. (auth)

21366 RADIOACTIVATION OF In-115 WITH GAMMA-RAYS FROM Co-60. Junichiro Furuta, H. Yoshiko Masuda, Tamotsu Kanazawa, and Toshio Azuma. Ann. Rept. Radiation Center Osaka Prefect., 2: 64-9(1961). (In English)

The activity of In^{115m} (0.335 Mev above ground state, half life 4.5 hr) induced in In by Co^{60} gamma rays was measured with and without scatterers (brass, lead, and aluminum). The integrated cross section was calculated to be 1.29 ± 0.3×10^{-31} cm^2, independent of the scatterer and In target thickness. The dose rate around a 3.8-kc Co^{60} basket was measured with In and found to agree with the dose rates determined with a rate meter. (D.L.C.)

21367 A SIMPLE MEASURING PROCEDURE FOR EVALUATING THE EMISSION OF TRITIUM FROM ACTI-

VATED ILLUMINANTS IN IMMERSION TESTING. E. H. Graul, R. Futterknecht, and H. Hundeshagen (Philipps-Universität, Marburg, Ger.). Atompraxis, 8: 175-82(May 1962). (In German)

A method with which tritium activity can be determined with the aid of scintillation phosphors is described. This is of particular importance for the monitoring of industrial plants, e.g., watch-making, in which tritium-activated illuminants are used. Calibration measurements for testing the measuring system are discussed. (auth)

21368 CARBON–CARBON ELASTIC SCATTERING. P. J. Bunyan (Univ. of Melbourne). Australian J. Phys., 15: 123-5(Mar. 1962).

An optical model for elastic scattering is applied to the carbon-carbon system using a Woods-Saxon potential with a Coulomb potential modified to allow for the finite size of the interacting nuclei. Calculations were made at 10.0 and 12.5 Mev; results at 10 Mev are presented in graphical form. (L.N.N.)

21369 PLANE POLARIZATION OF THE γ RAYS EMITTED BY AcC". Serge Gorodetzky, Francis Beck, Albert Knipper, Robert Manquenouille, and Raymond Richert. Compt. rend., 254: 2319-20(Mar. 26, 1962). (In French)

The polarization direction angular correlation in the decay AcC $\xrightarrow{(\alpha,\gamma)}$ AcC" was measured. The polarization found, $p = +0.622 \pm 0.021$, shows that the two transitions (α and γ) are mixed. The mixing coefficient for the γ ray is $\delta = +0.279 \pm 0.044$. (tr-auth)

21370 ON THE ANGULAR DISTRIBUTION OF NEUTRON FLUX OF T(d,n) REACTION APPARATUS. Osamu Yamamoto and Haruma Yoshinaga (Hiroshima Univ.). Hiroshima J. Med. Sci., 10: 23-7(June 1961).

The reactions $Fe^{56}(n,p)Mn^{56}$ and $Cr^{52}(n,p)V^{52}$ were observed after irradiation of a stainless steel plate with fast (14.1 Mev) neutrons. Measurement of the angular distribution of neutron flux density by the first reaction gave a value of ±25%. This neutron source can be used in all directions for irradiation, but to irradiate an object uniformly, such as a group of small animals, it is suggested that the method of revolving irradiation be employed. (H.H.D.)

21371 TOTAL YIELD AND ANGULAR DISTRIBUTION OF NEUTRONS EMITTED FROM Zr–T TARGET BOMBARDED BY DEUTERON BEAM. Yuen-kwei Tai, Yuen-chi Hsu, and Tung-hung Hsu (National Taiwan Univ., Taipei, China). Ho Tsu K'o Hsueh, 2: 29-34(1960). (In Chinese)

Total yield and angular distribution of neutrons emitted from a HZr–T–1 target (supplied by the ORNL) by the reaction $D^2 + T^3 \rightarrow He^4 + n^1 + 17.6$ Mev were measured. The amount of neutrons was estimated by counting the α-particles with a ZnS scintillation counter placed at a distance 1m from the Zr–T target. The total yield was 2×10^8 neutrons/sec at the deuteron energy 190 kev and current 100 A. The angular distribution was determined by rotating a $B^{10}F_3$ proportional counter about the Zr–T target. The distribution was isotropic between the angles 45° and 135° whereas considerable deviations were observed at other angles. A tentative explanation was offered in that the concrete walls of the observation room reflected the neutrons causing the deviations from isotropic. (TTT)

21372 THE RATIO OF NEUTRON CAPTURE TO FISSION FOR U^{233}. M. J. Cabell and L. J. Slee (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Nuclear Energy, Pts. A & B. Reactor Sci. and Technol., 16: 195-200(Apr. 1962). (AERE-R-3775)

The neutron temperature and epithermal index of three high-flux irradiation positions of Pluto are measured and determinations of alpha (the ratio of neutron capture to neutron fission) for U^{233} are made in each. Correcting all results to 2200-m/sec neutrons gives a mean value of $\alpha_8 = 0.0942 \pm 0.0016$. (auth)

21373 NEUTRON TOTAL CROSS SECTION OF U^{233}. D. C. Stupegia (Argonne National Lab., Ill.). J. Nuclear Energy, Pts. A & B. Reactor Sci. and Technol., 16: 201-3 (Apr. 1962).

The neutron total cross section of U^{233} is measured in the neutron energy range between 3.4 and 1611 kev. (auth)

21374 STUDY OF THE REACTIONS (p,αxn) ON THORIUM BOMBARDED WITH 155-Mev PROTONS. Xavier Tarrago (Laboratoire Joliot-Curie de Physique Nucléaire, Orsay, France). J. phys. radium, 23: 1-6(Jan. 1962). (In French)

From measurements of the cross sections of several isotopes of polonium (206 to 210) and astatine (206 to 211) produced by bombardment of thorium nuclei by 150-Mev protons, information was obtained on the mechanism of these reactions. It was assumed that polonium and astatine are produced through rapid alpha decay from neutron-deficient radium and actinium isotopes. These nuclei are formed by spallation (p,αxn) and (p,pαxn) reactions where x may be up to 14. For example, the calculated cross section without fission for (p,α14n) is 2.8 mb, and the experimental value was found to be 3 ± 1. (auth)

21375 FISSION-EVAPORATION COMPETITION. STUDY OF THE EXCITATION FUNCTIONS IN DIFFERENT PROTACTINIUM NUCLEI. C. Brun and G. N. Simonoff (Laboratoire Joliot-Curie de Physique Nucléaire, Orsay, France). J. phys. radium, 23: 12-16(Jan. 1962). (In French)

Excitation functions of isotopes 227, 228, and 230 of protactinium were obtained by bombarding thorium with 24 to 155 Mev protons. Comparison with calculated cross sections gives a test for the choice of parameters, particularly nuclear temperature. Nondependence of Γ_n/Γ_f with excitation energy is confirmed. (auth)

21376 CLASSES OF QUADRUPOLE MAGNETIC γ TRANSITIONS. Roger Foucher and Alceu de Pinho (Laboratoire de Physique Nucléaire, Orsay, France). J. phys. radium, 23: 22-4(Jan. 1962). (In French)

When M_2 experimental transition rates are classified according to their hindrance factors, four groups are found. Spherical and spheroidal shell models are employed to interpret experimental data and although the strongly inhibited transitions are well understood in terms of model dependent selection rules, the very accelerated ones are still difficult to account for. (auth)

21377 STUDY OF THE ELECTRODISINTEGRATION AND PHOTODISINTEGRATION OF OXYGEN-16. G. R. Bishop, B. Grossetête, and J. C. Risset (Laboratoire de l'Accélérateur Linéaire, École Normale Supérieure, Orsay, France). J. phys. radium, 23: 31-42(Jan. 1962). (In French)

Excitation curves for the production of O^{15}, N^{13}, and C^{11} by photodisintegration and electrodisintegration of O^{16} were measured from 60 to 150 Mev. By comparison of these two modes of production, the multipolarity of the transitions is studied. The first two isotopes are produced mainly at energies at about the giant resonance, the third at energies above 50 Mev. The integrated cross section of $O^{16}(\gamma,n)O^{15}$ $\int_{16\text{ Mev}}^{35\text{ Mev}} \sigma(\nu)\, d\nu = 64 \pm 9$ mb Mev. (auth)

21378 TIME-OF-FLIGHT SPECTROMETRY OF 15-Mev NEUTRONS SCATTERED BY CARBON. R. Barjon, Y. Flamant, and J. Perchereau, and A. Rode (Université, Algiers). J. phys. radium, 23: 60-1(Jan. 1962). (In French)

By using time-of-flight spectrometry of 14.8-Mev neutrons scattered by carbon, five different neutron groups could be distinguished. Four neutron groups from the reaction $C^{12}(n,n')C^{12}$ leave the carbon either in its ground state or in its first three excited levels, and a fifth group corresponds very probably to the (α,n) decomposition of C^{13}. The experimental apparatus used for the measurements is described in some detail. In the experimental results a large group of neutrons was found between the groups corresponding to the second and third excited levels. It seems that the existence of this group can be explained by comparing it to neutrons from the (α,n) decomposition of C^{13} with transition to the 6.76-Mev level of Be^9. (J.S.R.)

21379 ANGULAR MOMENTUM QUANTUM NUMBER AND HYPERFINE STRUCTURE SPLITTING OF THE GROUND STATE IN THE Ho^{165} I SPECTRUM. L. S. Goodman, H. Kopfermann, and K. Schluepmann (Universität, Heidelberg). Naturwissenschaften, 49: 101-2(1962). (In German)

The magnetic dipole transitions between Zeeman terms of the hfs terms of the ground state were observed in the Ho^{165} I spectrum. The transitions observed are tabulated, and the hfs interaction constants are calculated. No magnetic octupole interaction was found. (J.S.R.)

21380 STUDY OF THE CADMIUM ISOTOPES. I. BETA AND GAMMA RAY SPECTROSCOPY OF Ag^{110m}. Toshio Katoh and Yasukazu Yoshizawa (Osaka Univ.). Nuclear Phys., 32: 5-24(Apr. 1962). (In English)

Using a beta-ray spectrometer and scintillation spectrometers, beta and gamma from the decay of Ag^{110m} (250 d) were studied. The maximum energies of the four beta rays were 0.53, 1.4, 2.18, and 2.87 Mev from the beta-ray spectrum. A beta ray having a maximum energy of about 0.084 Mev was observed, but the maximum energy could not be determined accurately because of the counter window absorption and the existence of the isomeric transition. From the internal conversion electron spectrum, 15 gamma rays were detected and the transition energies were 0.115, 0.4462, 0.6189, 0.6577, 0.676, 0.688, 0.7072, 0.7451, 0.7643, 0.8153, 0.8846, 0.9368, 1.382, 1.474, and 1.504 Mev. The 0.676 and the 0.688-Mev gamma were found. These new gamma rays save the discrepancies among the gamma-ray intensities. Multipolarities of the gamma were assigned, comparing the measured K/(L + M) ratios and the K-shell internal conversion coefficients with the theoretical values. Considering Ritz's law (the energy rule), Kirchhoff's law (the intensity rule), the cascade relation (the coincidence and the summing peak methods), and selection rule (the beta-ray forbiddenness and gamma-ray multipolarity), a decay scheme was proposed. The spins and parities of levels, relative intensities of gamma, and log ft of beta rays were discussed from the viewpoint of nuclear structure. The spins of the levels of the second excited group were 2+ and 4+, and the energy ratios of these levels and the first excited level were about 2.3. These facts support the vibrational model. The higher excited states of Cd^{110} and the energy and the multipolarity of the isomeric transition of Ag^{110m} are discussed. (auth)

21381 STUDY OF THE CADMIUM ISOTOPES. II. BETA AND GAMMA RAY SPECTROSCOPY OF In^{110}. Toshio Katoh, Masao Nozawa, and Yasukazu Yoshizawa (Osaka Univ.). Nuclear Phys., 32: 25-70(Apr. 1962). (In English)

Beta rays, internal-conversion electrons, and gamma rays emitted in the decay of In^{110} and In^{110m} were studied using beta and scintillation spectrometers. Sources are produced by the $Ag^{107}(\alpha,n)In^{110}$ and $Ag^{109}(\alpha,3n)In^{110}$ reactions. Half lives of both isomers are 4.9 ± 0.2 hr and 66 ± 2 min. The maximum energy of the beta ray of In^{110} (66 min) is 2.20 ± 0.02 Mev. The weak beta ray of In^{110m} (4.9 hr) is found using the triple coincidence method. Many gamma transitions of In^{110m} and In^{110} are obtained from the internal conversion spectra and the summing peak and the coincidence spectra. The decay scheme is established, using Ritz's law, Kirchhoff's law, the cascade relation, and the selection rule. The new levels of 3.122, 2.249, 2.126, and 2.005 Mev are proposed for Cd^{110}, in addition to the decay of Ag^{110m}. The 0.121-Mev gamma which is assigned as M1 or E2 by the K/(L + M) ratio is estimated to be the gamma following the low-energy isomeric transition; the beta transition from In^{110} to the 1.474-Mev levels is observed; and the reduced transition probabilities of high energy gamma rays (≳1 Mev) are much smaller than other low-energy transitions. The weak and the intermediate coupling collective models and the asymmetric rotor model are compared with these data. The systematics of the even nuclei in the Cd region are described. The energies of the first 2+ states show a maximum at A = 110. In the Cd odd-mass nuclei the spins and parities of the ground states change from $^5/_2$+ to $^1/_2$+ between A = 109 and 111. The energy of the 3+ state is nearly equal to the sum of the first 2+ and 4+ states, rather than that of the first and the second 2+ states. The reduced transition probability from the ground state to the first 2+ state depends linearly on the energy between these states. The reduced transition probabilities of the high-energy gamma (≳1 Mev) between the higher-excited states are much smaller than those of the low-energy gamma, just as the cascade and the crossover transitions from the second excited state. The log ft value of the transition from the low spin isomer to the second 2+ state is larger than the values to the ground and the first excited states, and there is a beta-transition having a small log ft value which is fed from each high spin isomer to a higher excited state. It was attempted to explain these systematics by the superfluid model of the nucleus. (auth)

21382 A MONTE CARLO METHOD FOR NUCLEAR MANY BODY PROBLEMS. Erich W. Schmid (Florida State Univ., Tallahassee and Oak Ridge National Lab., Tenn.). Nuclear Phys., 32: 82-97(Apr. 1962). (In English)

A Monte Carlo method is given to solve nuclear many-body problems in the frame of the Ritz' variational principle. The antisymmetrization and all integrations are performed by a random process. The method is formulated for a two cluster system, using oscillator wave functions and hard core forces, but it can be generalized to arbitrary forces and wave functions. The ground state energy and rms-radius of the α-particle was calculated. For the final parameter values, an accuracy in the energy of 10% (2%) was obtained after a calculation time of 40 sec (16 min) using an IBM 7090 computer. The accuracy in the radius is improved by a factor 8. The minimum energy strongly depends on the form of the trial wave function near the hard core. (auth)

21383 ON THE NATURE OF THE 686 kev LEVEL OF Re^{187}. H. A. Vartapétian (Inst. of Physics, Academy of Sciences, Erevan, USSR). Nuclear Phys., 32: 98-101 (Apr. 1962). (In French)

The half life of the 686-kev level in Re^{187} was measured by the delayed coincidence method; $T_{\frac{1}{2}} = (2 \pm 0.7) \times 10^{-10}$ sec. The E1 and E2 transition probabilities are compared with probabilities calculated using the Nilsson model. The 686-kev level need not be vibrational. (auth)

21384 MUON CAPTURE AND RADIATIVE PION CAPTURE IN He^3. A. Fujii (Imperial College, London) and D. J. Hall. Nuclear Phys., 32: 102-5(Apr. 1962). (In English)

An interpolation method is described to obtain the nuclear matrix element of the muon capture reaction $\mu^- + He^3 \rightarrow H^3 + \nu$ from those of the radiative pion capture process $\pi^- + He^3 \rightarrow H^3 + \gamma$ and the beta decay process $H^3 \rightarrow He^3 + e + \bar{\nu}$. (auth)

21385 SOME ACTIVATION MEASUREMENTS AND A COMPARISON WITH THEORETICAL (n,2n) CROSS SECTIONS AND ISOMERIC CROSS SECTION RATIOS. E. Weigold and R. N. Glover (Australian National Univ., Canberra). Nuclear Phys., 32: 106-13(Apr. 1962). (In English)

Cross sections are measured for the reactions $Co^{59}(n,2n)$, $Zn^{64}(n,2n)$, and $Zn^{64}(n,p)$ at 13.8 to 14.8 Mev. At 14.7 ± 0.3 Mev, 20 ± 5 μb is obtained for the $S^{32}(n,t)$ cross section and an upper limit of 0.1 mb for $Ca^{40}(n,t)$. The Co^{58} isomeric cross section ratio for the (n,2n) reaction and ratios reported for other reactions leading to Co^{58} are compared with theory and shown to be consistent with a value of approximately 4 for the parameter σ which characterizes the dependence of the nuclear level density on angular momentum. Using nuclear temperatures derived from spectrum measurements (n,2n), cross sections calculated from the Weisskopf-Ewing formula agree with data for cases in which the implicit theoretical assumption (that the second particle emitted is always a neutron) is valid. A criterion is derived to identify cases in which the assumption is invalid. (auth)

21386 DEVIATION FROM I(I+1) DEPENDENCE IN NUCLEAR ROTATIONAL SPECTRA. Per Chr. Hemmer (Norges Tekniske Høgskole, Trondheim, Norway). Nuclear Phys., 32: 128-39(Apr. 1962). (In English)

The energy of a system of non-interacting fermions in a precessing shell-model oscillator potential is calculated to the fourth order in the total angular momentum. The deviation from the simple rotational pattern of a symmetric top is a sensitive function of the deformation of the system. Results fit observed trends and agree with corresponding data for strongly-deformed even nuclei. (auth)

21387 CALCULATION OF THE MOMENTS OF INERTIA OF NUCLEI BY THE METHOD OF APPROXIMATE SECOND QUANTIZATION. Zygmunt Galasiewicz (Univ. of Wrocław, Poland). Nuclear Phys., 32: 140-50(Apr. 1962). (In English)

An expression for the moments of inertia of nuclei is derived by applying the method of approximate second quantization, the nucleon pairing being considered. Results are identical with those obtained by applying a variant of the general canonical transformation method. The case of weakly deformed nuclei is treated by specifying the quantum numbers which characterize the one-particle states. (auth)

21388 NUCLEAR MAGNETIC MOMENTS IN THE RARE EARTH REGION. Ingvar Lindgren (Univ. of Uppsala). Nuclear Phys., 32: 151-67(Apr. 1962). (In English)

Approximate analytical radial wave functions of the type of $R \propto r^n e^{-ar} \cosh[\kappa(ar - n')]$ were determined for the 4f electrons in all neutral and triply ionized atoms of the rare earth series (Z = 57–70). They are fitted to the SCF wave functions for Pr^{3+} and Tm^{3+} by a least-square method and a procedure of interpolation and extrapolation with the subsidiary condition to reproduce the experimental spin-orbit couplings. The parameter n′ can, with sufficient accuracy, be set equal to the principal quantum number n. These wave functions are used to calculate values of $\langle r^{-3} \rangle$, with an estimated accuracy of about 5%. All magnetic moments determined from the hfs of 4f electrons are recalculated, and the new values are about 25% larger than those originally given. The total uncertainty is assumed to be about 10%, partly due to perturbations in the electronic states. Comparison is made with calculations, and the new moments agree with those obtained using the collective model in the second half of the series. (auth)

21389 ENERGY SPECTRUM OF γ-RAYS FROM HIGH ENERGY NUCLEAR COLLISIONS. I. ESTIMATION OF PHOTON ENERGIES. E. M. Friedländer, E. Gombosi, M. Marcu, M. Spîrchez (Inst. of Atomic Physics, Bucharest). Nuclear Phys., 32: 168-74(Apr. 1962). (In English)

As a first step in the determination of the energy spectrum of γ rays from high-energy nuclear interactions, an investigation of the relative spreads of "angular" and "scattering" energy estimates and an absolute calibration of the "angular" method for the case of projected angles was carried out. It was shown by "scattering" and "angle" measurements on 100 pairs in emulsion irradiated by 7.3 Bev pions and 9 Bev protons that the simple projected-opening angle measurement yields results of nearly the same accuracy as the "scattering" method. (auth)

21390 A NON-LOCAL POTENTIAL MODEL FOR THE SCATTERING OF NEUTRONS BY NUCLEI. F. Perey and B. Buck (Oak Ridge National Lab., Tenn.). Nuclear Phys., 32: 353-80(May 1962). (In English)

An energy independent non-local optical potential for neutron elastic scattering from nuclei is proposed and the wave-equation solved numerically in its full integro-differential form. The non-local kernel is assumed separable into a potential form factor times a Gaussian non-locality. The potential form factor, of argument $\frac{1}{2}(r + r')$, is that of a real Saxon form plus an imaginary term having the shape of the derivative of a Saxon form. A real local spin-orbit potential of the usual Thomas form is included. The parameters of the potential obtained solely from the fitting of the differential cross sections for lead at 7 and 14.5 Mev are used unchanged to calculate the elastic differential cross sections, total and reaction cross sections and polarizations on some elements ranging from Al to Pb at 0.4 to 24 Mev. The S-wave strength functions and the effective scattering radius R′ are also calculated. The parameters are: real potential V = 71 Mev, r = 1.22 fm, a = 0.65 fm; surface imaginary potential W = 15 Mev, a = 0.47 fm; non-locality β = 0.85 fm; spin-orbit potential, using the nucleon mass in the Thomas form, U_{SO} = 1300 Mev. The energy independence of the potential parameters allows the compound elastic scattering to be included below 4 Mev. The calculations are compared to the data over the whole energy range, and the quality of the agreement with the data is comparable to that obtained using energy-dependent local optical potentials. A "local WKB" approximation to the integro-differential equation is derived and gives an approximate relation between the non-local potential and the equivalent local optical potential. (auth)

21391 NUCLEAR SCATTERING AT HIGH ENERGIES. N. R. Steenberg (European Organization for Nuclear Research, Geneva). Nuclear Phys., 32: 381-400(May 1962). (In English)

A semi-empirical optical-type model is proposed for the elastic and quasi-elastic scattering of nucleons by nuclei in the Bev region where the interaction is mainly absorptive. The model is not based on a smooth nuclear potential, but takes into account the granular nature of nuclear matter. It predicts, at large scattering angles, a nucleon-like tail to the differential cross-section observed in preliminary experiments. It is made to conform to the optical theorem and to the requirement of consistency $\int d\sigma = \sigma_s$. The result for the differential cross-section is a simple formula containing nucleon and nuclear form factors. It is applied to experimental results. (auth)

21392 DIRECTION AND POLARIZATION ANGULAR CORRELATIONS OF GAMMA-RAY CASCADES IN Pb^{208}. G. T. Wood and P. S. Jastram (Washington Univ., St. Louis). Nuclear Phys., 32: 411-29(May 1962). (In English)

Polarization-direction and directional angular correlation measurements were made on three gamma cascades in Pb^{208} following the beta decay of Tl^{208}. Results lead to specific electromagnetic transition parameters and to spin and parity assignments for four of the excited levels in Pb^{208}. Results of existing internal conversion measurements agree with those computed from the transition assignments and mixing ratios, provided finite nuclear size (without penetration effects) is taken into account. (auth)

21393 REACTION MECHANISMS IN LOW ENERGY INELASTIC PROTON SCATTERING. Hiroshi Taketani and W. Parker Alford (Univ. of Rochester, N. Y.). Nuclear Phys., 32: 430-51(May 1962). (In English). (NYO-9751)

A number of (p,p′) angular distributions and (p,p′γ) angular correlations was measured to investigate the reaction mechanisms in inelastic proton scattering at low energies. Angular distributions were measured at the energies (center-of-mass) indicated: Ar^{40} 6.14 Mev (first, second, and third excited states); Ni^{58} 4.70, 5.64, 6.65-6.80 Mev (first excited state); Ni^{60} 4.69, 5.63, 6.65-6.80 Mev (first excited state); and Cu^{65} 6.83 Mev (second and third excited states). Angular correlations between protons leading to the first excited state and subsequent decay gamma rays were measured for Si^{28}, 5.66, 6.70 Mev, $\theta_{p'} = 45, 90, 135°$; S^{32} 5.66 Mev, $\theta_{p'} = 90, 135°$; Ti^{48} 5.72, 6.77 Mev, $\theta_{p'} = 90, 135°$; Ni^{58} 5.73, 6.80 Mev, $\theta_{p'} = 45, 90, 135°$; Ni^{60} 5.73, 6.80 Mev, $\theta_{p'} = 50, 90, 135°$. For the odd-mass nucleus Cu^{65}, the angular distributions show a prominent forward peaking, suggesting the importance of a direct interaction mechanism. For the even nuclei near A = 60, angular distributions and correlations show agreement with the predictions of the statistical compound nucleus model for proton energies less than 6 Mev but indicate an appreciable direct interaction contribution at 7 Mev. Angular correlations for Si^{28} show that direct interactions are important at 5.66 and 6.70 Mev. It appears that the importance of direct interaction relative to compound nucleus contributions increases rapidly as the energy of the incident and emergent protons approaches the height of the Coulomb barrier, though the structure of the nuclear states involved is also important in determining this ratio. (auth)

21394 ENERGY LEVELS IN ^{16}N FROM $^{15}N(n, n)^{15}N$ ELASTIC SCATTERING. C. P. Sikkema (Universiteit, Groningen, Netherlands). Nuclear Phys., 32: 470-81(May 1962). (In English)

Elastic $N^{15}(n,n)N^{15}$ scattering between 1.9 and 3.5 Mev is studied by the recoil particle method. A N_2^{15} filled proportional counter is used. The total cross section is measured by integral pulse counting and angular distributions are deduced from pulse-height distributions. The result is presented as a total cross section curve and Legendre polynomial expansion coefficients (B_0 through B_4) of angular distributions at 50 neutron energies. Analysis is made in terms of levels in N^{16} between 4.3 and 5.8 Mev excitation. Evidence is found for the 2 broad single-particle states $(1p_{\frac{1}{2}})^{-1}\ 1d_{\frac{5}{2}}$ with $J^\pi = 1^-$ and 2^- predicted by the shell model, at about 5.0 Mev. Six narrower levels are found, spins and parities of which are partly determined. (auth)

21395 ACTIVATION CROSS SECTIONS OF Hf^{178m}(4.3 sec) AND Hf^{179m}(18.6 sec) FOR THERMAL NEUTRONS. K. F. Alexander and H. F. Brinckmann (Zentralinstitut für Kernphysik, Rossendorf, Ger.). Nuclear Phys., 32: 482-9 (May 1962). (In German)

Using a pulsed neutron beam, the formation of Hf^{178m} and Hf^{179m} by thermal neutron capture in natural hafnium was investigated. For the decay of Hf^{178m}, a half-life of 4.3 ± 0.1 sec was found. By comparing the γ intensities from the Hf isomers with the prompt γ radiation of a B target exposed in the same position to the neutron beam, absolute activation cross sections were determined. The following values were found: $Hf^{177}(n,\gamma)Hf^{178m}$ (4.3 sec): $\sigma_{act} = 1.4 \pm 0.6$ b, $Hf^{178}(n,\gamma)Hf^{179m}$ (18.6 sec): $\sigma_{act} = 50 \pm 15$ b. The isomeric cross-section ratios $\sigma_{act}/\sigma_{abs}$ for Hf^{178m} and Hf^{180m} are almost equal; the compound states of these two nuclides formed by thermal neutron capture probably have the same spin, J = 4. The possibility of a strong transition leading directly to the 18.6-sec isomeric state in Hf^{179} is discussed. (auth)

21396 LEVELS IN ^{150}Sm FROM THE DECAY OF ^{150}Eu. R. A. Ricci (Instituut voor Kernphysisch Onderzoek, Amsterdam), R. Van Lieshout, G. B. Vingiani, S. Monaro, and B. Van Nooijen. Nuclear Phys., 32: 490-8(May 1962). (In English)

The decay of 14.0 ± 0.5 hr Eu^{150} to Sm^{150} and Gd^{150} was studied using scintillation techniques. Only one gamma ray of 620 kev seems to be associated with the negaton branch, but two gamma rays of 334 and 405 kev follow the position and capture branch, as well as gamma transitions of 715, 830, 920, 960, 1070, 1180, 1240, 1400, 1610, and 1920 kev. Gamma-gamma coincidences and angular correlation measurements establish the existence of a 2^+ level at 334 and a 0^+ level at 739 kev. Further levels in Sm^{150} are at 1050, 1170, 1250, 1920, and, possibly, 1980 kev. The spin of the Eu^{150} ground state is probably 1; speculations are made on possible proton and neutron orbital assignments. (auth)

21397 Cu-ISOTOPES BY THE UNIFIED MODEL. M. Bouten and P. Van Leuven (Studiecentrum voor Kernenergie, Mol, Belg.). Nuclear Phys., 32: 499-503(May 1962). (In English)

The experimental data of the odd-mass Cu-isotopes are interpreted on the basis of the unified model. A value of the $3p_{\frac{3}{2}} - 3p_{\frac{1}{2}}$ and $3p_{\frac{3}{2}} - 4f_{\frac{5}{2}}$ single proton level splittings is determined. (auth)

21398 INTERPRETATION OF GENERALIZED CLUSTER WAVE FUNCTIONS. Y. C. Tang (Florida State Univ., Tallahassee), K. Wildermuth, and L. D. Pearlstein. Nuclear Phys., 32: 504-9(May 1962). (In English)

It is shown that the indistinguishability of the nucleons has a large influence upon the correlation nature of a generalized cluster wave function. To interpret the physical meaning of such a wave function correctly, the degree of cluster overlap implied by this wave function must be known. (auth)

21399 MUON CAPTURE RATES FOR ^{44}Ca AND ^{40}Ca: OBSERVATION OF THE ISOTOPE EFFECT. W. A.

Cramer, V. L. Telegdi, and R. Winston (Univ. of Chicago) and R. A. Lundy. Nuovo cimento (10), 24: 546-8(May 1, 1962). (In English)

Time distribution of capture products was used for determining μ disappearance; results are presented in graphical form. A diagram and a description of the apparatus are given. Observed and predicted values for the isotope effect are compared, and fair agreement is obtained. (L.N.N.)

21400 OBSERVATION OF THE HYPERFINE EFFECT IN MUON CAPTURE BY $^{19}_{9}F$ via THE TIME-DEPENDENCE OF THE DECAY ELECTRON RATE. R. A. Lundy (Argonne National Lab., Ill.), W. A. Cramer, G. Culligan, V. L. Telegdi, and R. Winston. Nuovo cimento (10), 24: 549-53 (May 1, 1962). (In English)

The hyperfine effect in μ capture by F^{19} is confirmed. The rate at which neutrons are emitted following μ arrival in K shells is not affected by branching ratio effects. The decay symmetry parameter for μ^- bound to the $I = \frac{1}{2}$ nucleus F^{19} is -0.021 ± 0.007, about $\frac{1}{2}$ that of μ^- in C; μ^-'s in crystalline LiF, at least in a longitudinal field of ~100 gauss, are not subject to appreciable spin relaxation in the mesic K orbit. (L.N.N.)

21401 THE REACTION $^7Be(n,\alpha)^4He$ AND PARITY CONSERVATION IN STRONG INTERACTIONS. P. Bassi (Università, Bologna and Istituto Nazionale di Fisica Nucleare, Bologna), B. Ferretti, G. Venturini, G. C. Bertolini, F. Cappellani, V. Mandl, G. B. Restelli, and A. Rota. Nuovo cimento (10), 24: 560-3(May 1, 1962). (In English)

Alpha particles from the reactions $Be^7 + n \rightarrow 2\alpha + \gamma$ and $Be^7 + n \rightarrow 2\alpha$ were studied. Attributing spin (2) to the state in which the thermal neutron is captured by Be^7, the upper limit found ($\sigma_1 \leq 0.16 \times 10^{-27}$ cm^2) for the cross section of $Be^7 + n \rightarrow 2\alpha$ corresponds to a limit of $F \leq 2.5 \times 10^{-5}$ (amplitude ratio of opposite-parity wave-function components). No conclusion is obtained in this sense if the neutron is captured in a state of spin (1). (L.N.N.)

21402 DEFINITION OF NUCLEAR POTENTIALS FROM DOUBLE DISPERSION RELATIONS IN FIELD THEORY AND POTENTIAL SCATTERING. F. Morey (Instituto de Fisica, Bariloche, Argentina). Nuovo cimento (10), 24: 585-605(May 16, 1962). (In English)

A method to describe the scattering of nucleons, through a nuclear potential consistent with the results of field theory, is presented. This potential results as a sum of ten potentials, five direct and five of the exchange type, each of them given by a superposition of Yukawa potentials. The weight functions for these superpositions are then shown to be obtainable from field theory through the use of double dispersion relations for the nucleon-nucleon system and of unitarity in potential scattering. (auth)

21403 DEUTERONS IN THE NUCLEAR MATTER. D. M. Redondo, W. M. Machado, and J. Osada (Universidade, São Paulo, Brazil). Nuovo cimento (10), 24: 688-97(May 16, 1962). (In English)

The size of a deuteron in nuclear matter with separable interactions is calculated. The deuteron becomes larger than in free space but it still exists, even in nuclear matter at fairly high densities. The ground-state energy of the nuclear matter is also calculated, by the approximation of taking into account the effect of hole motions in addition to particle-particle interactions. When the nucleon density is high, the effect of hole-hole interactions becomes important. (auth)

21404 ANALYSIS OF AN ALPHA-PARTICLE INTERACTION OF ENERGY ~10^{12} ev PER NUCLEON. P. L. Jain (Univ. of Buffalo). Nuovo cimento (10), 24: 698-712(May 16, 1962). (In English)

A nuclear interaction of the type $3 + 34\alpha$ having two energetic secondaries of type $2 + 12p(S_1)$ and $4 + 19p(S_2)$, which presumably were produced by the nucleons from the breakup of the original α particle, were observed in nuclear emulsions. The events were considered as nucleon-nucleon interactions and were analyzed by measuring the energies and angles of their secondary particles. The energy as calculated from the angular distributions of the shower particles of the primary and S_1 and S_2 is 900, 412, and 400 Bev per nucleon respectively. The energies of the primary and S_2 are in agreement approximately with an independent estimate obtained from the total energy dissipated. The energy of S_1, however, when analyzed the same way as that of the other two jets indicates that its energy, as determined from the angular distribution, is overestimated at least by a factor of two. The average transverse momentum of the shower particles is ~0.30 Bev/c. The energy and the angles of shower particles of these three events are transferred to the c.m.s., disclosing sharp collimation of particles of high energy at small angles with the shower axis. The energy distribution in the c.m.s. for these three events is peaked towards low values but shows a tail at high-energy values extending up to 2.5 Bev. The primary event is consistent with the "two-fire-ball" model (auth)

21405 A SEARCH FOR RADIOACTIVITY AMONG THE NATURALLY OCCURRING ISOBARIC PAIRS. D. E. Watt and R. N. Glover (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). Phil. Mag. (8), 7: 105-14(Jan. 1962).

Low-background techniques were used to search for radioactivity among the naturally occurring isobaric pairs Cd-113–In-113, In-115–Sn-115, Sb-123–Te-123, and Re-187–Os-187. No activity was observed from Cd-113 which is found to have a minimum half-life of 1.3×10^{15} years for emission of β rays with energy >1.2 kev. A new value of 480 ± 30 kev was obtained for the beta-disintegration energy of In-115 and the half life measured to be $5.1 \pm 0.4 \times 10^{14}$ years. The unstable member of the Sb–Te-123 pair is shown to be Te-123 which decays by K electron capture with a half life of $1.24 \pm 0.10 \times 10^{13}$ years. The decay of Re-187 is established by observation of the beta spectrum with maximum energy 1.2 ± 0.10 kev. The half life is estimated to be of the order of 3×10^{10} years. (auth)

21406 THE INTERACTIONS OF π^--MESONS WITH COMPLEX NUCLEI IN THE ENERGY RANGE (100-800) Mev. III. THE INTERACTION LENGTHS AND ELASTIC SCATTERING OF 300 Mev π^--MESONS IN G5 EMULSION. P. J. Finney, J. V. Major, and P. G. J. T. Parkhouse (Univ. of Durham, Eng.). Phil. Mag. (8), 7: 237-45(Feb. 1962).

A stack of pellicles was exposed to the 300 Mev π^--meson beam of the 660 Mev proton synchrotron at CERN, Geneva. The interaction lengths for the production of inelastic interactions and elastic scatterings through projected angles greater than 5°, found by scanning along 140 m of track, are (37.9 ± 2.0) and (77.4 ± 5.8) cm, respectively, compared to the geometrical interaction length of 29.3 cm. By comparison with the optical model the absorption coefficient and change in wave number are $(1.53 \pm 0.15)\ 10^{12}$ and $\pm (1.35 \pm 0.12)\ 10^{12}$ cm^{-1}, corresponding to a nuclear potential with a real component of (25 ± 1) Mev (of which the sign is not known), an imaginary component, $-(14.1 \pm 1.4)$ Mev and a mean free path for interaction in nuclear matter of $(6.5 \pm 0.7)\ 10^{-13}$ cm. The differences from the expected values are consistent with a considera-

ble reduction within the nucleus of the cross section for elastic scattering of π-mesons by nucleons. (auth)

21407 ENERGY LEVEL SCHEMES OF ^{23}Na, ^{27}Al, ^{31}P ON THE UNIFIED MODEL. A. B. Clegg and K. J. Foley (Clarendon Lab., Oxford). Phil. Mag. (8), 7: 247-53(Feb. 1962).

It is remarked that low-lying intrinsic states in distorted (4n-1)-nuclei can be formed by a single hole on otherwise filled Nilsson single-particle energy levels. Such intrinsic states should be produced strongly in medium energy (p, 2p) and (p, pn) reactions on 4n-nuclei. In this way such intrinsic states are identified in Na^{23}, Al^{27}, and P^{31}. Using this information an analysis is made of the low states of Na^{23} in terms of rotational bands which differs from a previous analysis. (auth)

21408 THE L/K-CAPTURE RATIO OF ARGON 37. P. W. Dougan, K. W. D. Ledingham, and R. W. P. Drever (Univ. of Glasgow). Phil. Mag. (8), 7: 475-82(Mar. 1962).

The ratio of L capture to K capture in the decay of argon-37 was measured using a multi-wire proportional counter system. The value obtained for the ratio, 0.102 ± 0.004, is in good agreement with the theoretical result which takes electron correlations into account. (auth)

21409 EVIDENCE FOR A LARGE B_{ij} CONTRIBUTION IN THE FIRST-FORBIDDEN BETA DECAY OF Rb^{86}. John D. Rogers and F. Boehm (California Inst. of Tech., Pasadena). Phys. Letters, 1: 113-14(May 15, 1962). (In English)

An experiment in which additional parameters are determined, making possible a complete analysis of Rb^{86} matrix elements, was performed. Beta-gamma circular polarization correlation in Rb^{86} was measured at 4 angles between 90 and 180°. Results indicate a large matrix element B_{ij}. It is concluded that a particular combination of the vector matrix elements $\int_i \vec{\sigma} \times \vec{r}$ and $\int \vec{r}$ contributes significantly to this beta decay. Data are presented in graphical and tabular forms. (L.N.N.)

21410 MEASUREMENT OF POLARIZATION OF PHOTONEUTRONS FROM Be^9. R. Boesch, J. Lang, R. Mueller, and W. Woelfli (Eidgenossiche Technische Hochschule, Zurich). Phys. Letters, 1: 114-15(May 15, 1962). (In German)

Using a 500-C Na^{24} source (E_γ = 2.753 Mev), beryllium-9 photoneutron polarization was measured. Asymmetry and polarization data are presented in graphical form. Results contradict previous theory. (L.N.N.)

21411 ELECTROMAGNETIC TRANSITIONS 6.92 → 6.13 Mev AND 7.12 → 6.13 Mev IN O^{16}. S. Gorodetzky, P. Mennrath, P. Chevallier, F. Scheibling, and G. Sutter (Institut de Recherches Nucléaires, Strasbourg). Phys. Letters, 1: 116-17(May 15, 1962). (In French)

Reactions $F^{19}(p,\alpha)O^{16}$ have large cross sections for the excitation of the O^{16} 7.12- and 6.92-Mev levels at proton energies of 2030 and 874 kev, respectively. The branching ratio for 0.99 Mev–6.13 Mev/7.12 Mev is estimated to be $(8 \pm 2) \times 10^{-4}$, and that for 0.79 Mev–6.13 Mev/6.92 to be $(2.5 \pm 1.5) \times 10^{-4}$. (T.F.H.)

21412 BETA-DECAY OF RaE; EVIDENCE FOR THE CONSERVED VECTOR CURRENT THEORY. R. M. Spector and R. J. Blin Stoyle (Oxford Univ.). Phys. Letters, 1: 118-20(May 15, 1962). (In English)

Phenomenological limits for two independent ratios of nuclear matrix elements for Bi^{210} were obtained and compared with experimental values of the energy-dependent shape correction factor and the electron polarization. Data are presented in graphical form. (L.N.N.)

21413 FLUCTUATIONS IN THE CROSS SECTION OF $Si^{28}(n,\alpha)Mg^{25}$ REACTION WITH FAST NEUTRONS. L. Colli, U. Facchini, I. Iori, G. M. Marcazzan, M. Milazzo, and F. Tonolini (Laboratori CISE, Milan). Phys. Letters, 1: 120-3(May 15, 1962). (In English)

Using a small accelerator, $Si^{28}(n,\alpha)Mg^{25}$ cross sections at 13.5 to 14.7 Mev were measured at 100-kev intervals. Cross section peaks are plotted as functions of neutron energy and the properties of the first Mg^{25} levels are tabulated. (L.N.N.)

21414 g-FACTOR OF 482 kev STATE OF ^{181}Ta MEASURED WITH THE DIFFERENTIAL METHOD. E. Bozek, A. Z. Hrynkiewicz, and J. Styczen (Inst. of Nuclear Physics and Jagellonian Univ., Krakow). Phys. Letters, 1: 126-7 (May 15, 1962). (In English)

Coincidence time spectra for the 133 to 482 kev γ-γ cascade were taken using two scintillation counters and having the source located in an external magnetic field perpendicular to the plane of successive γ rays. Measurements were performed at $\theta_1 = (5\pi/8)$ and $\theta_2 = (7\pi/8)$ between counter axes and for the two opposite directions of the magnetic field. Four coincidence time spectra were obtained. It is indicated that perturbation of the angular correlation could be present. (L.N.N.)

21415 DOUBLE EMISSION OF ^{8}Li FRAGMENTS IN THE INTERACTIONS OF 9 Gev PROTONS WITH HEAVY EMULSION NUCLEI. W. Gajewski, J. Pniewski, T. Pniewski, J. Siemińska, M. Sołtan, K. Sołtyński, and J. Suchorzewska (Univ. of Warsaw and Inst. of Nuclear Research, Warsaw). Phys. Letters, 1: 133-4(May 15, 1962). (In English)

The emission frequency of a fragment is strongly dependent on the excitation energy of the target nucleus. Hammer track fragments were used to investigate the higher values of the observed emission frequency of two fragments in one interaction. Seven pairs of Li^8 tracks were found, each pair was produced in one interaction; data are presented in tabular form. It was concluded that the emission of two heavy fragments can still be explained mainly as a chance coincidence. (L.N.N.)

21416 ANGULAR DISTRIBUTION AND RANGES OF N^{13} PARTICLES RESULTING FROM 27.5-Mev N^{14} IONS ON Mg^{24}. K. S. Toth (Oak Ridge National Lab., Tenn.). Phys. Rev., 126: 1489-92(May 15, 1962).

The angular distribution and ranges are reported for N^{13} nuclei resulting from the transfer reaction $Mg^{24}(N^{14},N^{13})Mg^{25}$ (Q = −3.22 Mev) at an incident N^{14} energy of 27.5 Mev. The data are compared to those reported previously for the reaction $Mg^{25}(N^{14},N^{13})Mg^{26}$ (Q = 0.57 Mev) to study the effect of Q. It is found that while the angular distributions are similar in shape, Mg^{26} states up to 7-Mev excitation contribute significantly to the reaction $Mg^{25}(N^{14},N^{13})Mg^{26}$ in contrast to the presented Mg^{24} data which show no Mg^{25} states above ~5 Mev contributing to the transfer process. The N^{13} ranges when expressed as a function of Q indicate the bulk of N^{13} particles lying between similar Q values for both reactions. Excited-state transfers predominate in the two magnesium reactions in contrast to results reported at the same N^{14} incident energy for B^{10} and N^{14} targets in which ground-state transfers accounted for approximately half of the total cross sections. The angular distributions are replotted as $d\sigma/dR_{min}$ vs R_{min} and r_0's calculated for the peak values of R_{min}; the r_0's are 1.6 f and 155 f for Mg^{24} and Mg^{25} targets, respectively. The magnesium data are compared to the tunneling theory for transfer reactions and fair agreement is found. (auth)

21417 PROTON ANGULAR DISTRIBUTIONS FOR (α,p) REACTIONS ON C^{12}, Al^{27}, AND P^{31}. A. J. Lieber, F. H. Schmidt, and J. B. Gerhart (Univ. of Washington, Seattle). Phys. Rev., 126: 1496-1502(May 15, 1962).

Angular distributions of protons corresponding to single and multiple levels of excitation have been measured for the reactions $C^{12}(\alpha,p)N^{15}$, $Al^{27}(\alpha,p)Si^{30}$, and $P^{31}(\alpha,p)S^{34}$ using 42-Mev alpha particles. Distributions corresponding to the ground state and third-excited state of N^{15} and to the ground state and first-excited state of S^{34} show pronounced diffraction-like structure. Distributions from Si^{30} show a marked lack of structure. The data indicate that simple phasing relationships between distributions from levels of even and odd parity, predicted by models based on the plane-wave Born approximation, do not agree with experiment. The ground-state distribution from N^{15} is in agreement with the theories of Butler and Bhatia. However, the observed distribution from the third-excited state of N^{15} does not agree with the predictions of these theories. Total cross sections obtained for the ground state and third-excited state of N^{15} were large compared with those for low-level transitions in the reactions on phosphorus and aluminum. These in turn have much larger cross sections than those for $Na^{23}(\alpha,p)Mg^{26}$, $F^{19}(\alpha,p)Ne^{22}$, and $Cl^{35}(\alpha,p)Ar^{38}$, which were too small to be investigated with the apparatus. There is some indication from this investigation that those distributions which show pronounced angular structure have cross sections that are more highly dependent on bombarding energy than those that lack structure. (auth)

21418 ELECTRIC QUADRUPOLE MOMENT OF THE 14.4-kev STATE OF Fe^{57}. C. E. Johnson, W. Marshall, and G. J. Perlow (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Phys. Rev., 126: 1503-6(May 15, 1962).

From a measurement of the Mössbauer absorption spectrum of ferrous fluosilicate for polarized 14.4-kev radiation, the quadrupole moment of the first excited state of Fe^{57} is deduced to be +0.12 b. This value is subject to a small correction due to the internal Sternheimer effect for the Fe^{2+} ion. (auth)

21419 SIGN OF THE Li^8 MAGNETIC MOMENT. Donald Connor and Tung Tsang (Argonne National Lab., Ill.). Phys. Rev., 126: 1506-7(May 15, 1962).

The sign of the magnetic dipole moment of Li^8 has been found experimentally to be positive, in agreement with theoretical expectation. Rates of transition among the Zeeman levels were compared for the two senses of circular polarization of a resonant rf field (1977 kc/sec in 3139 gauss). The short half-life (0.85 sec) of Li^8 required use of the polarized neutron-activation, beta-emission anisotropy detection, method previously applied to the measurement of the Li^9 nuclear g factor. (auth)

21420 LONG-RANGE PARTICLES FROM NUCLEAR FISSION. Ralph A. Nobles (Los Alamos Scientific Lab., N. Mex.). Phys. Rev., 126: 1508-13(May 15, 1962).

A measurement of the probability of emission of long-range particles, which are known to be predominantly alpha particles, made with a multiple ionization chamber gave the following results for spontaneous fission: Cf^{252}, 299 ± 18; Cm^{242}, 257 ± 17; Cm^{244}, 314 ± 20; Pu^{240}, 314 ± 20; and Pu^{242}, 365 ± 29 fissions per long-range particle. The results for thermal neutron-induced fission of the following compound nuclei were: Pu^{240}, 411 ± 26; Pu^{242}, 440 ± 28; U^{236}, 449 ± 30; and U^{234}, 414 ± 26 fissions per long-range particle and for 1-Mev neutron-induced fission the results were: Pu^{240}, 403 ± 25; U^{236}, 534 ± 35; U^{235}, 466 ± 30 fissions per long-range particle. These data indicate a trend of increasing probability of emission of long-range particles with increasing Z^2/A values and decreasing probability with increasing excitation energy in a given nuclide. Present explanations of these apparently contradictory results seem inadequate. The energy spectra of long-range particles from spontaneous fission of Cf^{252} and thermal neutron-induced fission of U^{235} were observed with a CsI crystal scintillation apparatus and were found to be identical within the accuracy of observations, showing slightly askew bell-shaped distributions with maxima at 17 ± 1 Mev and end-point energies of 29 ± 1 Mev. (auth)

21421 ELASTIC AND INELASTIC SCATTERING OF 43-Mev ALPHA PARTICLES BY Ni^{58} AND Ni^{60}. H. W. Broek, T. H. Braid, J. L. Yntema, and B. Zeidman (Argonne National Lab., Ill.). Phys. Rev., 126: 1514-20 (May 15, 1962).

Inelastic scattering and elastic scattering of 43-Mev α particles have been studied over the angular range from 17° to 53° cm. The angular distributions of the prominent group from the 2^+ first excited level and the 3^- "anomalous" group are fitted well by calculations based on the distorted-wave Born approximation. The angular distribution of the 4^+ group of 5.5 Mev in Ni^{58} also agrees well with the calculations. Groups at low excitation, with angular distributions in phase with elastic scattering, were found at 2.2 and 2.50 Mev in Ni^{60} and at 2.47 Mev in Ni^{58}. These groups violate the phase rule from Fraunhofer diffraction theory, and hence are believed to be due to two-phonon excitations. Other groups with angular distributions in phase with elastic scattering were found at 4.45, 6.8, and 7.1 Mev in Ni^{58} and at 4.05, 5.6, 6.2, and 7.0 Mev in Ni^{60}. Groups with angular distributions out of phase with elastic scattering were found at 1.45, 3.3, 5.5, and 5.9 Mev in Ni^{58} and at 1.33, 3.2, and 5.1 Mev in Ni^{60}. (auth)

21422 DECAY OF 2.1-HOUR Ta^{178}. C. J. Gallagher, Jr. and H. L. Nielsen (Univ. of Copenhagen). Phys. Rev., 126: 1520-4(May 15, 1962).

The allowed decay of 2.1-hr Ta^{178} has been reinvestigated, and the previously reported decay scheme has been almost completely confirmed. The multipolarity of the 331.7-kev transition between the 1480- and 1148-kev states has been reassigned as M1 on the basis of a measurement of its internal conversion coefficient. On the basis of the reassigned multipolarity, the beta-decay transition rates, and the recently measured spin 8 of the 1148-kev level, the 1148- and 1480-kev levels are interpreted, respectively, as two-proton and two-neutron states which are strongly admixed. (auth)

21423 COUPLING OF ANGULAR MOMENTA IN TWO-PARTICLE STATES IN DEFORMED EVEN-EVEN NUCLEI. C. J. Gallagher, Jr. (Univ. of Copenhagen). Phys. Rev., 126: 1525-31(May 15, 1962).

The recent suggestion that low-lying intrinsic states in deformed nuclei are basically two-particle excitations is considered in more detail. The result of the strong-coupling model that the two-particle states are doubly degenerate with spins $\Omega = |\Omega_1 \pm \Omega_2|$ is re-emphasized. It is suggested on the basis of experimental evidence that the degeneracy of the two states of each configuration is removed largely by residual spin-dependent forces, analogous to the splitting observed in deformed odd-odd nuclei. Coupling rules are given for the lower-lying state of each configuration based on this assumption. As an example of the application of the coupling rules to actual nuclei the decay schemes of the two Ta^{178} isomers to levels in Hf^{178} are considered in detail. (auth)

21424 NUCLEAR REACTIONS OF TANTALUM WITH 5.7-Gev PROTONS. J. Robb Grover (Brookhaven National Lab., Upton, N. Y. and Univ. of California, Berkeley). Phys. Rev., 126: 1540-54(May 15, 1962). (BNL-5867)

Radiochemically determined cross sections are reported for sixty-seven of the nuclides which appear as products of the nuclear reactions between 5.7-Bev protons and tantalum, and upper or lower limits are reported for thirty additional product nuclides. These data are distributed throughout the range of mass numbers $7 < A < 180$. The mass yield distribution obtained from the data is similar to the distribution reported by Wolfgang et al. for the interactions of 3-Bev protons with lead, and is consistent with their observations that (1) all mass numbers less than that of the target are represented with cross sections of at least a few millibarns; and (2) there is no obvious fission peak, even though a fission peak is clearly seen at lower bombarding energies (0.3 to 0.5 Bev). However, an objective criterion is devised which, when applied to the data, gives a result supporting the view that at least one reaction process other than spallation (presumably fission) is necessary to explain the observed shape of the mass yield distribution. Although for product mass numbers above $A \approx 70$ most of the measured cross sections represent "chain yields" of neutron-deficient nuclides, it is possible to determine the approximate locus in the N,Z plane of the line of isobaric independent yield maxima, up to $A \approx 150$. This line is compared with various calculated lines, given in the high-energy nuclear evaporation paper by Dostrovsky, Rabinowitz, and Bivins, in an effort to extract new information on the average excitation energy and neutron deficiency (or excess) of the nuclear evaporation progenitors as functions of the mass number, and on the nuclear state density parameter a. (auth)

21425 NUCLEAR REACTIONS INDUCED BY NEUTRINOS OF INTERMEDIATE ENERGY. H. Ueberall (Univ. of Michigan, Ann Arbor). Phys. Rev., 126: 1572-3(May 15, 1962).

Nuclear reactions with electron emission leading to all final nuclear states, induced by neutrinos of definite energy (e.g., from a source of stopped μ^-), are discussed on the basis of a Fermi gas model of the nucleus. It is shown that the cross section is not reduced very much below the sum of the single free nuclear cross sections, and that the emitted electron may be identified by kinematics. This offers the possibility for demonstrating the identity of "electron" and "muon" neutrinos. (auth)

21426 THE ANGULAR DISTRIBUTION OF THE NEUTRONS ARISING FROM THE NUCLEAR CAPTURE OF POLARIZED MUONS. A. Astbury, J. H. Bartley, I. M. Blair, M. A. R. Kemp, H. Muirhead, and T. Woodhead (Univ. of Liverpool). Proc. Phys. Soc. (London), 79: 1011-16 (May 1, 1962).

An experiment designed to measure the angular asymmetry of the neutrons emitted when polarized muons are captured by nuclei is described. The element used is S. After correcting for the depolarization of the muon beam, a value of -0.22 ± 0.07 is obtained for the asymmetry parameter. The non-zero result confirms the violation of parity conservation in the muon capture process, and the magnitude of the effect suggests the presence of an effective pseudoscalar term in the transition amplitude for the fundamental process $\mu^- + p \rightarrow n + \nu$. (auth)

21427 THE $^7Li(\alpha,\gamma)^{11}B$ REACTION. L. L. Green, G. A. Stephens, and J. C. Willmott (Univ. of Liverpool). Proc. Phys. Soc. (London), 79: 1017-32(May 1, 1962).

The reaction $Li^7(\alpha,\gamma)B^{11}$ is studied at resonances found at 951, 815, and 401 kev. The decay schemes are established, and it is shown that at the two upper resonances the decay via the 6.76–6.81 Mev doublet involves only the 6.76-Mev member. The analysis of the experimental data on angular correlations establishes the resonance spins, and also shows the 6.76- and 4.46-Mev levels to have spins $^7/_2^-$ and $^5/_2^-$, respectively. The transition from the 4.46-Mev state to ground is found to have an E2/M1 mixing amplitude of $+0.20 \pm 0.02$. The properties of the 6.76-Mev level are not in line with predictions of the independent-particle model. (auth)

21428 AN EXPERIMENTAL SURVEY OF (^{19}F,^{18}F) NEUTRON TRANSFER REACTIONS. J. L. Perkin, R. F. Coleman, and D. N. Herbert (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). Proc. Phys. Soc. (London), 79: 1033-40(May 1, 1962).

Thick targets of B^{10}, N^{14}, O^{16}, F^{19}, Na^{23}, Al^{27}, V^{51}, Mn^{55}, and Co^{59} were irradiated with F^{19} ions with energies up to 43 Mev. The yield of F^{18} from the neutron transfer reactions with these nuclides was measured by separating and counting fluorine from the irradiated targets. All the neutron transfer cross sections were found to increase from a lower limit of detection of about 0.2 mb to several mb at 43 Mev. The shapes of these excitation functions were compared with those expected from the theory for neutron transfer between the ground states of the interacting nuclei. Thin targets of Al^{27} were irradiated with 42.3- and 34.2-Mev F^{19} ions and the angular distribution of F^{18} was measured in each case over the range 0 to 178° in the laboratory system. A pronounced peak in the angular distributions was observed corresponding to neutron transfer from Rutherford orbits at the closest distance of approach. The value of the reduced radius R_0 at this distance for both energies was found to be 1.7 ± 0.05 fermis. (auth)

21429 COMPARISON BETWEEN CLUSTER AND SHELL MODELS FOR ^6Li. Daphne F. Jackson (Battersea College of Tech., London). Proc. Phys. Soc. (London), 79: 1041-8(May 1, 1962).

The experimental results for elastic electron scattering from Li^6 are fitted using a cluster model. The value obtained for the r.m.s. radius of the alpha cluster is very close to that for a free alpha particle. This is in contrast to calculations using a shell model, which indicate that in this model the alpha core in Li^6 is considerably larger than the alpha particle. Electron scattering data do not distinguish between the two models. (auth)

21430 CHART OF THE NUCLIDES—EXPLANATION OF THE CHART OF THE NUCLIDES. SECOND EDITION 1961. W. Seelmann-Eggebert and G. Pfennig, comp. Washington, D. C., National Research Council. 6p. $1.00.

A chart of nuclides is given together with an explanation of the chart. The data were obtained primarily from the Nuclear Data Sheets issued by the National Research Council, Washington, D. C. Original literature was taken into account up to July 1961. Cross sections were taken from BNL-325, 2nd edition (July 1, 1958) and its supplement (January 1, 1960). On the chart the number of protons was entered on the ordinate axis and the number of neutrons on the abscissa. (M.C.G.)

21431 ELECTROMAGNETIC LIFETIMES AND PROPERTIES OF NUCLEAR STATES. Proceedings of a Conference, Gatlinburg, Tenn., October 5-7, 1961. (National Research Council. Committee on Nuclear Science). 1962. 265p. (NAS-NRC-Pub-974). $2.00(NAS).

Nuclear Science Series Report Number 37.

Thirty-three papers are included; separate abstracts

have been prepared for 30. Three papers were previously abstracted in NSA. (T.F.H.)

21432 ENHANCEMENT OF ELECTROMAGNETIC TRANSITION PROBABILITIES. Dieter Kurath (Argonne National Lab., Ill.). p.10-14 of "Electromagnetic Lifetimes and Properties of Nuclear States." Washington, D. C., National Research Council, Committee on Nuclear Science, 1962.

Strongly correlated nuclear states give rise to intense gamma transitions of various multipolarities. These correlations represent the effect of residual nucleonic interactions, and are quite susceptible to interpretation for closed-shell or near-closed-shell nuclei. Ways in which correlated states may be used in order to obtain information about the residual interaction are outlined, especially within the framework of the nuclear shell models. (T.F.H.)

21433 EFFECTIVE MOMENTS IN NUCLEI. A. deShalit (Weizmann Inst., Rehovoth, Israel). p.15-20 of "Electromagnetic Lifetimes and Properties of Nuclear States." Washington, D. C., National Research Council, Committee on Nuclear Science, 1962.

In the interpretation of transition probabilities of nuclei, the real, strongly interacting particles are sometimes replaced by independent particles having modified intrinsic properties. The propriety of such a replacement is questioned in the case of the nuclear magnetic moment. By considering several nuclei, it is concluded that the magnetic moment is of the form $\vec{\mu} = \Sigma\, \vec{\mu}_i$, not $\vec{\mu} = \Sigma\, \vec{\mu}_i + \frac{1}{2} \Sigma\, \vec{\mu}_{ij}$ $(i \neq j)$; that is, that the magnetic moments of the nucleons have their independent-particle values. Thus nucleon-nucleon interactions have little or no effect on the magnetic moment of a given nucleon. (T.F.H.)

21434 REVIEW OF LATEST DEVELOPMENTS IN DELAYED-COINCIDENCE MEASUREMENTS. Arthur Schwarzschild (Brookhaven National Lab., Upton, N. Y.). p.30-49 of "Electromagnetic Lifetimes and Properties of Nuclear States." Washington, D. C., National Research Council, Committee on Nuclear Science, 1962. (BNL-5175)

The use of scintillation detectors in the analysis of cascade emission with high time and energy resolution is reviewed. The characteristics of various delayed coincidence systems are outlined. Some results are given as examples (e.g., decay of the first excited states of Tl^{203}, Th^{226}, Ra^{222}, and several lifetimes in Hf^{177}). Circuitry designed to improve the resolution is discussed. Centroid measurements are investigated, using the decay of K^{42} as an example. (T.F.H.)

21435 PARTICLE BEAM LIFETIME MEASUREMENTS. G. Goldring (Weizmann Inst. of Science, Rehovoth, Israel). p.50-6 of "Electromagnetic Lifetimes and Properties of Nuclear States." Washington, D. C., National Research Council, Committee on Nuclear Science, 1962.

Measurements of nuclear energy levels and their lifetimes by means of pulsed-beam techniques are considered. Problems encountered in improving the time and energy resolution of these measurements are studied. The energy and multipolarity characteristics of all investigated energy levels are outlined. (T.F.H.)

21436 RECENT DEVELOPMENTS IN FAST PHOTOMULTIPLIERS. G. A. Morton (RCA Labs., Princeton, N. J.). p.57-62 of "Electromagnetic Lifetimes and Properties of Nuclear States." Washington, D. C., National Research Council, Committee on Nuclear Science, 1962.

The photoelectric and physical characteristics of three types of fast photomultiplier tubes are reviewed. The tubes have curved cathodes, multiple dynodes, and time resolutions of 0.3 to 2 nsec. (T.F.H.)

21437 PULSE CHARACTERISTICS OF SOME PAST PHOTOTUBES. C. W. Williams (Oak Ridge National Lab., Tenn.), R. P. Cumby, and J. H. Neiler. p.63-4 of "Electromagnetic Lifetimes and Properties of Nuclear States." Washington, D. C., National Research Council, Committee on Nuclear Science, 1962.

The pulse characteristics of several phototubes, such as the rise time, transit time differences for photoelectrons emitted from various points on the photocathode, gain, and pulse amplitude, are measured using a pulsed light source having a rise time and width at half maximum of about 0.5 nsec. (T.F.H.)

21438 THE HIGH FREQUENCY DEFLECTION METHOD FOR MEASURING SHORT HALF-LIVES. T. Alvager (Argonne National Lab., Ill. and Nobel Inst. of Physics, Stockholm) and B. Johansson. p.65-9 of "Electromagnetic Lifetimes and Properties of Nuclear States." Washington, D. C., National Research Council, Committee on Nuclear Science, 1962.

A method is presented for analyzing cascade electron-electron emission with a time resolution of about 0.1 nsec. The emitted electrons are analyzed by a pair of spectrometer magnets, each of which is tuned to one of the cascade-electron energies. The two electron beams are deflected by r-f electric fields, and the phase difference at which the counting rates of the beams are maximized is converted into a time lag between the electron emissions. Cascades in Bi^{206}, Bi^{212}, and U^{233} are shown as examples. (T.F.H.)

21439 METHOD FOR CALIBRATING AND TESTING TIME TO PULSE HEIGHT CONVERTERS. H. de Waard (Universiteit, Groningen, Netherlands) and H. Beekhuis. p.71-7 of "Electromagnetic Lifetimes and Properties of Nuclear States." Washington, D. C., National Research Council, Committee on Nuclear Science, 1962.

In order to calibrate a time-to-pulse-height converter, the photomultiplier pulses normally furnishing the input to the converter are replaced by standard pulses from secondary emission tubes. The time difference between the arrival of these pulses can be varied electronically. The pulses are mixed and applied to a uhf receiver tuned exactly to 500 Mc. Thus minima and maxima appear in the converter output, as a function of the time difference, and the output may be used to check the converter's calibration. The method includes a means for correcting small drifts in the converter. The decay of positrons in Al is shown as an example. (T.F.H.)

21440 MEASUREMENTS OF NUCLEAR LIFETIMES WITH A TIME-TO-HEIGHT CONVERTER. S. Gorodetzky (Université, Strasbourg), R. Manquenouille, R. Richert, and A. C. Knipper. p.79-83 of "Electromagnetic Lifetimes and Properties of Nuclear States." Washington, D. C., National Research Council, Committee on Nuclear Science, 1962.

The calibration and use of a time-to-pulse-height converter for delayed-coincidence measurements of the lifetimes of excited states of Pr^{141}, Yb^{170}, Ta^{181}, W^{182}, In^{115}, I^{132}, Pr^{143}, Tb^{159}, Tl^{205}, Pb^{207}, B^{10}, Al^{25}, Al^{26}, Al^{28}, and Ca^{41} are described. (T.F.H.)

21441 RECOIL METHODS FOR MEASUREMENT OF LIFETIMES OF NUCLEAR STATES. S. Devons (Columbia Univ., New York). p.86-96 of "Electromagnetic Lifetimes and Properties of Nuclear States." Washington, D. C., National Research Council, Committee on Nuclear Science, 1962.

The relative merits of recoil-distance and Doppler-shift recoil methods in the measurement of lifetimes down to 10^{-13} sec are outlined. For the Doppler-shift methods, the pertinent kinematical parameters are reviewed, the meas-

urement of γ energy changes is discussed, and slowing-down times are considered. Doppler-shift measurements of several nuclear lifetimes are reported. (T.F.H.)

21442 LIFETIME MEASUREMENTS USING RESONANCE FLUORESCENCE. F. R. Metzger (Bartol Research Foundation, Swarthmore, Penna.). p.97-106 of "Electromagnetic Lifetimes and Properties of Nuclear States." Washington, D. C., National Research Council, Committee on Nuclear Science, 1962.

The methods of producing resonant gamma rays, the ranges of lifetime (10^{-13} to 10^{-9} sec) and gamma energy (1 to 10^5 ev) applicable to these methods, and the factors influencing the accuracy and reliability of lifetime measurements obtained using these methods are reviewed. Only the free recoil case is considered. (T.F.H.)

21443 A DIFFRACTION MONOCHROMATOR FOR THE STUDY OF NUCLEAR RESONANCE EXCITATION. F. Boehm (California Inst. of Tech., Pasadena), J. W. M. DuMond, H. E. Henrikson, and E. J. Seppi. p.106-9 of "Electromagnetic Lifetimes and Properties of Nuclear States." Washington, D. C., National Research Council, Committee on Nuclear Science, 1962.

A 30- to 250-kev photon monochromator is described that consists of a powerful x-ray source and a bent single crystal of Ge or quartz. The curved crystal can be rotated with respect to the incident x rays; thus the crystal serves as a variable monochromator. Resonance lines in F^{19} and Mn^{55} are shown as examples. (T.F.H.)

21444 LIFETIMES BY COULOMB EXCITATION. E. M. Bernstein (Univ. of Texas, Austin). p.110-18 of "Electromagnetic Lifetimes and Properties of Nuclear States." Washington, D. C., National Research Council, Committee on Nuclear Science, 1962.

The determination of lifetimes of nuclear states from measurements of Coulomb excitation cross sections and yields is investigated. Particular attention is devoted to E2 excitation processes. Measurements on several nuclei are shown as examples. (T.F.H.)

21445 E0 TRANSITION PROBABILITIES. Mitsuo Sakai (Tokyo Univ.). p.120-4 of "Electromagnetic Lifetimes and Properties of Nuclear States." Washington, D. C., National Research Council, Committee on Nuclear Science, 1962.

The E0 transition probabilities for transitions from second 2+ states to first 2+ states are studied in Os^{188}, Os^{190}, Pt^{194}, and Hg^{198}. Beta-gamma and gamma-gamma angular correlations are measured for these nuclei, and the nuclear q-values are determined from the data (q is defined as the number of E0 K-conversion electrons per E2 K-conversion electron). (T.F.H.)

21446 METHODS OF DETERMINING NUCLEAR MOMENTS OF EXCITED STATES. Kurt Alder (Universität, Basel). p.126-39 of "Electromagnetic Lifetimes and Properties of Nuclear States." Washington, D. C., National Research Council, Committee on Nuclear Science, 1962.

A review is given showing how the quadrupole moment of odd-A and even-even rare earth nuclei can be determined by rotational-model analysis of the reduced electric quadrupole transition probability B(E2), or by analysis of electron or other particle scattering; further, it is shown how the gyromagnetic ratios of odd-A nuclei can be similarly determined from the B(M1) values. Model-independent methods for nuclear measurements are also reviewed, including hyperfine structure methods (Mossbauer effect, atomic beam methods, etc.), angular correlation and distribution effects, and reorientation effects. (T.F.H.)

21447 EXPERIMENTAL DETERMINATION OF NUCLEAR PROPERTIES BY USE OF THE MOSSBAUER EFFECT. S. S. Hanna (Argonne National Lab., Ill.). p.140-53 of "Electromagnetic Lifetimes and Properties of Nuclear States." Washington, D. C., National Research Council, Committee on Nuclear Science, 1962.

The use of the Mossbauer effect to measure nuclear magnetic moments, quadrupole moments, and sizes is reviewed. Cross sections and lifetimes pertinent to the Mossbauer effect are studied. (T.F.H.)

21448 MAGNETIC MOMENTS OF EXCITED STATES USING RESONANCE FLUORESCENCE. B. I. Deutch (Bartol Research Foundation, Swarthmore, Penna.). p.153-9 of "Electromagnetic Lifetimes and Properties of Nuclear States." Washington, D. C., National Research Council, Committee on Nuclear Science, 1962.

The procedures involved in the measurement of magnetic moments of nuclear excited states by resonance fluorescence techniques are reviewed, viz. measurement of the gamma lifetime or resonant cross section, measurement of the angular distribution or differential resonant cross section, and measurement of the precession of the angular distribution in an external magnetic field. Measurements on Lu^{175}, Fe^{56}, and Tl^{203} excited states are discussed as examples. It is noted that very short lifetimes may be measured by these techniques. (T.F.H.)

21449 EFFECTS OF NUCLEAR PENETRATION ON ELECTRON-GAMMA CORRELATIONS. T. R. Gerholm (Univ. of Uppsala) and B. G. Pettersson. p.159-68 of "Electromagnetic Lifetimes and Properties of Nuclear States." Washington, D. C., National Research Council, Committee on Nuclear Science, 1962.

The "penetration matrix" elements for internal-conversion electrons, i.e., the factors expressing the nuclear-structure dependence of the internal conversion process, are reviewed for M1 and E2 transitions and are discussed for E1 transitions. The relation of the penetration matrix elements to the nuclear radial matrix elements is outlined. Measurements of the gamma-gamma, electron-gamma, and gamma-electron correlations in the gamma-gamma cascades in Tl^{201} and Tl^{203} are used to validate the proposed penetration-matrix theory. Experimental results on the strongly retarded 482-kev transition in Ta^{181} are presented. (T.F.H.)

21450 INELASTIC ELECTRON SCATTERING FROM DISCRETE NUCLEAR LEVELS. H. W. Kendall (Massachusetts Inst. of Tech., Cambridge). p 168-70 of "Electromagnetic Lifetimes and Properties of Nuclear States." Washington, D. C., National Research Council, Committee on Nuclear Science, 1962.

Excitation of nuclear levels by inelastic scattering of 300- to 7000-Mev electrons discloses that E4 excitation is a fairly common phenomenon. General results for several nuclei are given. (T.F.H.)

21451 ELECTROMAGNETIC TRANSITIONS FROM THE CONTINUUM. R. F. Christy (California Inst. of Tech., Pasadena). p.173-6 of "Electromagnetic Lifetimes and Properties of Nuclear States." Washington, D. C., National Research Council, Committee on Nuclear Science, 1962.

An outline is given of gamma transitions involving extranuclear (continuum) contributions, particularly resonant and nonresonant gamma scattering and (p,γ) nuclear reactions. Wave functions and matrix elements for these reactions are discussed. (T.F.H.)

21452 PROTON CAPTURE TRANSITIONS. E. K. Warburton (Brookhaven National Lab., Upton, N. Y.).

p.180-204 of "Electromagnetic Lifetimes and Properties of Nuclear States." Washington, D. C., National Research Council, Committee on Nuclear Science, 1962.

A survey is given of the implications of the E1 and M1 gamma lifetimes of unbound-proton states of light (AS40) nuclei, as found from (p,γ) reactions. It is found that the gamma transitions obey isotopic-spin selection rules quite well; and that the features of the transition can be represented in the shell model, especially for p-shell nuclei. Attention is given to direct and indirect reactions and to configuration mixing. (T.F.H.)

21453 $O^{16}(p,\gamma)F^{17}$ DIRECT RADIATIVE CAPTURE. G. M. Griffiths (Univ. of British Columbia, Vancouver), M. Lal, and L. P. Robertson. p.205-8 of "Electromagnetic Lifetimes and Properties of Nuclear States." Washington, D. C., National Research Council, Committee on Nuclear Science, 1962.

Calculations are carried out for the $O^{16}(p,\gamma)F^{17}$ reaction in the proton energy interval from 15 to 2400 kev, using a single-particle model with a square well potential and a Coulomb barrier to represent the interaction between the O^{16} core and the odd proton. The radial integrals for E1 transitions from the continuum proton state to final $2s_{\frac{1}{2}}$ and $1d_{\frac{5}{2}}$ states are evaluated numerically for assumed nuclear radii of 3.7 and 4.8 fermi. The results for a radius of 4.8 fermi are in agreement with the experimental data. (T.F.H.)

21454 NEUTRON CAPTURE TRANSITIONS. G. A. Bartholomew (Atomic Energy of Canada Ltd., Chalk River, Ont.). p.209-19 of "Electromagnetic Lifetimes and Properties of Nuclear States." Washington, D. C., National Research Council, Committee on Nuclear Science, 1962.

Experimental and theoretical studies of the lifetimes and primary gamma radiation widths of neutron capture (n,γ) transitions from unbound excited states of nuclei are summarized. Only E1 and M1 transitions are studied. The capture of both thermal and higher-energy neutrons is considered. Anomalies in the intensities of high-energy gamma transitions are examined. (T.F.H.)

21455 THE GIANT DIPOLE RESONANCE TRANSITIONS IN NUCLEI. R. A. Ferrell (Univ. of Maryland, College Park). p.220-4 of "Electromagnetic Lifetimes and Properties of Nuclear States." Washington, D. C., National Research Council, Committee on Nuclear Science, 1962.

Giant resonance gamma scattering in deformed and undeformed light nuclei and in heavy nuclei is examined. The use of the shell model in interpretation of the experimental results is discussed. Giant resonance effects in (p,γ) reactions are also outlined. A shell-model analysis of the damping of the giant resonance is summarized. (T.F.H.)

21456 RESONANT SCATTERING OF γ RAYS IN GIANT RESONANCE REGION. A. Bussiere de Nercy and M. Langevin (Lab. de Physique Nucleaire, Orsay, France). p.224-6 of "Electromagnetic Lifetimes and Properties of Nuclear States." Washington, D. C., National Research Council, Committee on Nuclear Science, 1962.

Giant-resonance scattering of bremsstrahlung with a maximum energy of 22 Mev by Al^{27}, P^{31}, Ca, Ta^{181}, and Bi^{209} is reported. The resonance widths for the Ta and Bi nuclides are shown. All the giant resonances studied have a dipole nature. (T.F.H.)

21457 ANGULAR MOMENTUM DEPENDENCE OF GAMMA RAY YIELDS FROM COMPOUND NUCLEUS REACTIONS. James F. Molleauer (Brookhaven National Lab., Upton, N. Y.). p.227-30 of "Electromagnetic Lifetimes and Properties of Nuclear States." Washington, D. C., National Research Council, Committee on Nuclear Science, 1962.

The gamma yields, anisotropies, and energies from C^{12} and α reactions on Ba, Ho, Te, Ta, Co, and V are compared with predictions of independent-particle and collective models of nuclear excitation. The latter model is found to correspond more closely to the experimental findings. (T.F.H.)

21458 MEASUREMENTS OF E1 TRANSITION PROBABILITIES IN SEVERAL DEFORMED ODD-A NUCLEI AS A STUDY OF SINGLE PARTICLE MOTION. U. Hauser (California Inst. of Tech., Pasadena), E. N. Hatch, K. Rang, G. Knissel, and W. Schneider. p.230-3 of "Electromagnetic Lifetimes and Properties of Nuclear States." Washington, D. C., National Research Council, Committee on Nuclear Science, 1962.

Transition probabilities for hindered E1 transitions in odd-A nuclei in the rare earth region are reported and discussed. Particular attention is given to transitions from a single-particle state to a rotational band, and to differences between single-particle states in neighboring nuclides. (T.F.H.)

21459 AN ASYMMETRIC CORE COLLECTIVE MODEL FOR ODD-A NUCLEI. J. P. Davidson (Rensselaer Polytechnic Inst., New York) and B. E. Chi. p.237-42 of "Electromagnetic Lifetimes and Properties of Nuclear States." Washington, D. C., National Research Council, Committee on Nuclear Science, 1962.

A nuclear Hamiltonian is constructed that consists of two parts, a rotational part and a particle part, for use in the interpretation of odd-A nuclei by an asymmetric-core collective model. The Hamiltonian must be computer-diagonalized for each chosen set of nuclear parameters. The predictions of this model regarding the energies, spins, and parities of excited states of O^{17}, F^{19}, Mg^{25}, and Al^{25} up to 8 Mev are compared with the experimental results. (T.F.H.)

21460 ASYMMETRIC ROTOR THEORIES OF EVEN-EVEN NUCLEI. C. A. Mallmann (Universidad, Buenos Aires). p.242-5 of "Electromagnetic Lifetimes and Properties of Nuclear States." Washington, D. C., National Research Council, Committee on Nuclear Science, 1962.

The motivation of the use of the asymmetric-rotor nuclear model rather than a symmetric-rotor model is discussed. The development of the asymmetric-rotor model is traced. (T.F.H.)

21461 PROPERTIES OF COLLECTIVE STATES IN OSMIUM 186. G. T. Emery, W. R. Kane, M. McKeown, M. L. Perlman, and G. Scharff-Goldhaber (Brookhaven National Lab., Upton, N. Y.). p.246-52 of "Electromagnetic Lifetimes and Properties of Nuclear States." Washington, D. C., National Research Council, Committee on Nuclear Science, 1962.

An energy level scheme is presented for Os^{186} up to 2300 kev. Most of the levels up to 1752 kev can be classed into a K = 0 and a K = 2 group. The experimental reduced transition probabilities (B values) are compared with the asymmetric-rotor and strong-coupling model predictions, and with calculations based on interactions between the K = 0 and K = 2 bands. In addition, for Os^{186}, Os^{188}, and Os^{190}, the discrepancies between the nuclear parameters calculated from the gamma energies and from the B values are tabulated. (T.F.H.)

21462 PROCEEDINGS OF THE RUTHERFORD JUBILEE INTERNATIONAL CONFERENCE, MANCHESTER, 1961. J. B. Birks, ed. New York, Academic Press Inc., 1961. 856p. $32.00

Proceedings of the Rutherford Jubilee International Conference are presented. Two hundred and one papers and 17 abstracts of papers are included. Separate abstracts were prepared for 179 papers. Twenty-two were previously abstracted for NSA. (M.C.G.)

21463 NUCLEAR FORCES. H. Pierre Noyes (Univ. of California, Livermore). p.65-82 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961. (UCRL-6536-T)

The theories and models for nuclear forces are reviewed. Interactions, proton scattering, static potential models, meson theory, nucleon-nucleon interactions, pion-exchange effects, and the dispersion relation approach to quantitative models are discussed. (M.C.G.)

21464 THE INTERACTION OF FAST NUCLEONS WITH NUCLEI. H. McManus (Michigan State Univ., East Lansing). p.83-102 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Information obtained on nuclear structure by three types of high-energy experiments are discussed. The three types of experiment are: elastic scattering, inelastic scattering, and the p-2p reaction. It is shown that information on the nuclear density distribution and optical potential can be obtained by elastic scattering. In the Born approximation, enelastic scattering measures the product $\overline{V(q)}F_{no}(q)$, suitably averaged over spin where $F_{no}(q)$ is the mixed form factor, the Fourier transform of the overlap integral which provides the information about the structure of the nuclear state N. The p-p'-γ experiment is suggested as a tool for investigating effects of distorted waves, nuclear structure, and perhaps renormalizing the impulse approximation scattering coefficients. (M.C.G.)

21465 HYPERNUCLEI AND THE HYPERON-NUCLEON INTERACTION. R. H. Dalitz (Univ. of Chicago). p.103-37 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Studies were made of Λ-hypernuclei to obtain information on the Λ-N interaction and on the nature of strange particles. The parities of hyperons were investigated. The theory of hyperon-nucleon forces is discussed. The Λ-hypernuclear binding energies were analyzed. The well-depth of the potential experienced by a Λ particle in nuclear matter was studied. The possibility of excited states in Λ-hypernuclei is discussed. It was concluded that a strong spin-dependence in the Λ-N interaction is necessary to account for Λ-hypernuclear binding energies and that the singlet potential is about twice as strong as the triplet potential in the S-state. (M.C.G.)

21466 THE $^{12}C(n,np)^{11}B$, $^{12}C(p,pn)^{11}C$ AND $^{12}C(p,2p)^{11}B$ REACTIONS INDUCED BY NUCLEONS OF 120-150 Mev. F. M. Austin, G. L. Salmon, D. J. Rowe, A. B. Clegg, D. Newton, and K. J. Foley (Oxford Univ.). p.139-40 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Measurements of the gamma rays emitted from residual nuclei from the $C^{12}(n,np)$, $C^{12}(p,pn)$, and $C^{12}(p,2p)$ reactions were made, determining the populations of the states of the residual nuclei in these simple knockout processes. The results determine, to a first approximation, the parentage of the ground state of C^{12}. It was found that the ground state of B^{11}, C^{11} is produced approximately 80% of the time. An appreciable production of the second excited state ($J = 5/2-$) was observed which would not be produced in a simple knockout process if C^{12} is purely the configuration $1s^4 1p^8$. (auth)

21467 THE SCATTERING OF HIGH-ENERGY DEUTERONS FROM NUCLEI. L. J. Campbell and A. K. Kerman (Massachusetts Inst. of Tech., Cambridge). p.141-2 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

By extension of the formalism for nucleon-nucleus scattering at high energies, a theory for high energy nucleus-nucleus elastic scattering was obtained. Using the optical potential derived, the cross section and vector polarization for deuteron–carbon elastic scattering was calculated in the Born approximation. (M.C.G.)

21468 GAMMA-RAYS FROM INELASTIC SCATTERING OF HIGH ENERGY PROTONS FROM CARBON. D. J. Rowe, G. L. Salmon, A. B. Clegg, and D. Newton (Oxford Univ.). p.145-6 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Measurements were made of the angular correlation of gamma rays and protons from the inelastic scattering of 150 Mev protons from the J = 2 + first excited state of C^{12}, observing gamma rays both in and out of the scattering plane. The results enable the effects of distorted waves to be separated and measurements made of individual nuclear matrix elements. (auth)

21469 TWO-QUANTA-EXCHANGE IN THE RATIO OF THE TOTAL (e,N)- TO THE TOTAL (γ,N)-CROSS-SECTION. Rudolf Rodenberg (Universität, Tübingen, Ger.). p.147-8 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

This paper was previously abstracted from the original language and appears in NSA, Vol. 16, abstract no. 12523.

21470 THE BINDING ENERGY OF A Λ PARTICLE IN NUCLEAR MATTER AND THE Λ-N INTERACTION. A. R. Bodmer and S. Sampanthar (The University, Manchester, Eng.). p.151-2 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The potential felt by a Λ in nuclear matter, this being considered as a Fermi gas, was calculated using perturbation theory. Two-body, direct and exchange, Yukawa forces and 3-body forces were considered. The second order contributions, the effect of nuclear pair correlations, and the velocity dependence are all small. The nucleon exchange factor used for the 3-body forces strongly suppresses their effect in nuclear matter. The implications of empirical values of the Λ-potential depth were considered. In particular if the pion-baryon couplings predominate then strongly attractive 3-body forces, corresponding to a larger singlet than triplet 2-body volume integral, are favored. (auth)

21471 SHELL STRUCTURE INVESTIGATION BY ELECTRON SCATTERING ON NUCLEAR PROTONS. Gerhard Jacob and Th. A. J. Maris (Universidade do Rio Grande, Sul Pôrto Alegre, Brazil). p.153-4 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

It is shown that, from angular correlation measurements on energy selected electron-proton pairs resulting from quasi-free scattering, detailed information on the shell structure of light and medium nuclei can be obtained. A calculation for C^{12} was performed, leading to the conclusion that the distortion of the outgoing proton wave

p.180-204 of "Electromagnetic Lifetimes and Properties of Nuclear States." Washington, D. C., National Research Council, Committee on Nuclear Science, 1962.

A survey is given of the implications of the E1 and M1 gamma lifetimes of unbound-proton states of light (AS40) nuclei, as found from (p,γ) reactions. It is found that the gamma transitions obey isotopic-spin selection rules quite well; and that the features of the transition can be represented in the shell model, especially for p-shell nuclei. Attention is given to direct and indirect reactions and to configuration mixing. (T.F.H.)

21453 $O^{16}(p,\gamma)F^{17}$ DIRECT RADIATIVE CAPTURE. G. M. Griffiths (Univ. of British Columbia, Vancouver), M. Lal, and L. P. Robertson. p.205-8 of "Electromagnetic Lifetimes and Properties of Nuclear States." Washington, D. C., National Research Council, Committee on Nuclear Science, 1962.

Calculations are carried out for the $O^{16}(p,\gamma)F^{17}$ reaction in the proton energy interval from 15 to 2400 kev, using a single-particle model with a square well potential and a Coulomb barrier to represent the interaction between the O^{16} core and the odd proton. The radial integrals for E1 transitions from the continuum proton state to final $2s_{\frac{1}{2}}$ and $1d_{\frac{5}{2}}$ states are evaluated numerically for assumed nuclear radii of 3.7 and 4.8 fermi. The results for a radius of 4.8 fermi are in agreement with the experimental data. (T.F.H.)

21454 NEUTRON CAPTURE TRANSITIONS. G. A. Bartholomew (Atomic Energy of Canada Ltd., Chalk River, Ont.). p.209-19 of "Electromagnetic Lifetimes and Properties of Nuclear States." Washington, D. C., National Research Council, Committee on Nuclear Science, 1962.

Experimental and theoretical studies of the lifetimes and primary gamma radiation widths of neutron capture (n,γ) transitions from unbound excited states of nuclei are summarized. Only E1 and M1 transitions are studied. The capture of both thermal and higher-energy neutrons is considered. Anomalies in the intensities of high-energy gamma transitions are examined. (T.F.H.)

21455 THE GIANT DIPOLE RESONANCE TRANSITIONS IN NUCLEI. R. A. Ferrell (Univ. of Maryland, College Park). p.220-4 of "Electromagnetic Lifetimes and Properties of Nuclear States." Washington, D. C., National Research Council, Committee on Nuclear Science, 1962.

Giant resonance gamma scattering in deformed and undeformed light nuclei and in heavy nuclei is examined. The use of the shell model in interpretation of the experimental results is discussed. Giant resonance effects in (p,γ) reactions are also outlined. A shell-model analysis of the damping of the giant resonance is summarized. (T.F.H.)

21456 RESONANT SCATTERING OF γ RAYS IN GIANT RESONANCE REGION. A. Bussiere de Nercy and M. Langevin (Lab. de Physique Nucleaire, Orsay, France). p.224-6 of "Electromagnetic Lifetimes and Properties of Nuclear States." Washington, D. C., National Research Council, Committee on Nuclear Science, 1962.

Giant-resonance scattering of bremsstrahlung with a maximum energy of 22 Mev by Al^{27}, P^{31}, Ca, Ta^{181}, and Bi^{209} is reported. The resonance widths for the Ta and Bi nuclides are shown. All the giant resonances studied have a dipole nature. (T.F.H.)

21457 ANGULAR MOMENTUM DEPENDENCE OF GAMMA RAY YIELDS FROM COMPOUND NUCLEUS REACTIONS. James F. Molleanuer (Brookhaven National Lab., Upton, N. Y.). p.227-30 of "Electromagnetic Lifetimes and Properties of Nuclear States." Washington, D. C., National Research Council, Committee on Nuclear Science, 1962.

The gamma yields, anisotropies, and energies from C^{12} and α reactions on Ba, Ho, Te, Ta, Co, and V are compared with predictions of independent-particle and collective models of nuclear excitation. The latter model is found to correspond more closely to the experimental findings. (T.F.H.)

21458 MEASUREMENTS OF E1 TRANSITION PROBABILITIES IN SEVERAL DEFORMED ODD-A NUCLEI AS A STUDY OF SINGLE PARTICLE MOTION. U. Hauser (California Inst. of Tech., Pasadena), E. N. Hatch, K. Rurup, G. Knissel, and W. Schneider. p.230-3 of "Electromagnetic Lifetimes and Properties of Nuclear States." Washington, D. C., National Research Council, Committee on Nuclear Science, 1962.

Transition probabilities for hindered E1 transitions in odd-A nuclei in the rare earth region are reported and discussed. Particular attention is given to transitions from a single-particle state to a rotational band, and to differences between single-particle states in neighboring nuclides. (T.F.H.)

21459 AN ASYMMETRIC CORE COLLECTIVE MODEL FOR ODD-A NUCLEI. J. P. Davidson (Rensselaer Polytechnic Inst., New York) and B. E. Chi. p.237-42 of "Electromagnetic Lifetimes and Properties of Nuclear States." Washington, D. C., National Research Council, Committee on Nuclear Science, 1962.

A nuclear Hamiltonian is constructed that consists of two parts, a rotational part and a particle part, for use in the interpretation of odd-A nuclei by an asymmetric-core collective model. The Hamiltonian must be computer-diagonalized for each chosen set of nuclear parameters. The predictions of this model regarding the energies, spins, and parities of excited states of O^{17}, F^{19}, Mg^{25}, and Al^{25} up to 8 Mev are compared with the experimental results. (T.F.H.)

21460 ASYMMETRIC ROTOR THEORIES OF EVEN-EVEN NUCLEI. C. A. Mallmann (Universidad, Buenos Aires). p.242-5 of "Electromagnetic Lifetimes and Properties of Nuclear States." Washington, D. C., National Research Council, Committee on Nuclear Science, 1962.

The motivation of the use of the asymmetric-rotor nuclear model rather than a symmetric-rotor model is discussed. The development of the asymmetric-rotor model is traced. (T.F.H.)

21461 PROPERTIES OF COLLECTIVE STATES IN OSMIUM 186. G. T. Emery, W. R. Kane, M. McKeown, M. L. Perlman, and G. Scharff-Goldhaber (Brookhaven National Lab., Upton, N. Y.). p.246-52 of "Electromagnetic Lifetimes and Properties of Nuclear States." Washington, D. C., National Research Council, Committee on Nuclear Science, 1962.

An energy level scheme is presented for Os^{186} up to 3350 kev. Most of the levels up to 1752 kev can be classed into K = 0 and a K = 2 group. The experimental reduced transition probabilities (B values) are compared with the asymmetric-rotor and strong-coupling model predictions, and with calculations based on interactions between the K = 0 and K = 2 bands. In addition, for Os^{186}, Os^{188}, and Os^{190}, the discrepancies between the nuclear parameters calculated from the gamma energies and from the B values are tabulated. (T.F.H.)

21462 PROCEEDINGS OF THE RUTHERFORD JUBILEE INTERNATIONAL CONFERENCE, MANCHESTER, 1961. J. B. Birks, ed. New York, Academic Press Inc., 1961. 856p. $32.00

Proceedings of the Rutherford Jubilee International Conference are presented. Two hundred and one papers and 17 abstracts of papers are included. Separate abstracts were prepared for 179 papers. Twenty-two were previously abstracted for NSA. (M.C.G.)

21463 NUCLEAR FORCES. H. Pierre Noyes (Univ. of California, Livermore). p.65-82 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961. (UCRL-6556-T)

The theories and models for nuclear forces are reviewed. Interactions, proton scattering, static potential models, meson theory, nucleon-nucleon interactions, pion-exchange effects, and the dispersion relation approach to quantitative models are discussed. (M.C.G.)

21464 THE INTERACTION OF FAST NUCLEONS WITH NUCLEI. H. McManus (Michigan State Univ., East Lansing). p.83-102 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Information obtained on nuclear structure by three types of high-energy experiments are discussed. The three types of experiment are: elastic scattering, inelastic scattering, and the p-2p reaction. It is shown that information on the nuclear density distribution and optical potential can be obtained by elastic scattering. In the Born approximation, enelastic scattering measures the product $\bar{T}(q)F_{nn}(q)$, suitably averaged over spin where $F_{nn}(q)$ is the mixed form factor, the Fourier transform of the overlap integral which provides the information about the structure of the nuclear state N. The p-p'-γ experiment is suggested as a tool for investigating effects of distorted waves, nuclear structure, and perhaps renormalizing the impulse approximation scattering coefficients. (M.C.G.)

21465 HYPERNUCLEI AND THE HYPERON-NUCLEON INTERACTION. R. H. Dalitz (Univ. of Chicago). p.103-37 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Studies were made of Λ-hypernuclei to obtain information on the Λ-N interaction and on the nature of strange particles. The parities of hyperons were investigated. The theory of hyperon-nucleon forces is discussed. The Λ-hypernuclear binding energies were analyzed. The well-depth of the potential experienced by a Λ particle in nuclear matter was studied. The possibility of excited states in Λ-hypernuclei is discussed. It was concluded that a strong spin-dependence in the Λ-N interaction is necessary to account for Λ-hypernuclear binding energies and that the singlet potential is about twice as strong as the triplet potential in the S-state. (M.C.G.)

21466 THE $^{12}C(n,np)^{11}B$, $^{12}C(p,pn)^{11}C$ AND $^{12}C(p,2p)^{11}B$ REACTIONS INDUCED BY NUCLEONS OF 120-150 Mev. S. M. Austin, G. L. Salmon, D. J. Rowe, A. B. Clegg, D. Newton, and K. J. Foley (Oxford Univ.). p.139-40 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Measurements of the gamma rays emitted from residual nuclei from the $C^{12}(n,np)$, $C^{12}(p,pn)$, and $C^{12}(p,2p)$ reactions were made, determining the populations of the states of the residual nuclei in these simple knockout processes. The results determine, to a first approximation, the parentage of the ground state of C^{12}. It was found that the ground state of B^{11}, C^{11} is produced approximately 80% of the time. An appreciable production of the second excited state ($J = \frac{1}{2}-$) was observed which would not be produced in a simple knockout process if C^{12} is purely the configuration $1s^4 1p^8$. (auth)

21467 THE SCATTERING OF HIGH-ENERGY DEUTERONS FROM NUCLEI. L. J. Campbell and A. K. Kerman (Massachusetts Inst. of Tech., Cambridge). p.141-2 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

By extension of the formalism for nucleon-nucleus scattering at high energies, a theory for high energy nucleus-nucleus elastic scattering was obtained. Using the optical potential derived, the cross section and vector polarization for deuteron–carbon elastic scattering was calculated in the Born approximation. (M.C.G.)

21468 GAMMA-RAYS FROM INELASTIC SCATTERING OF HIGH ENERGY PROTONS FROM CARBON. D. J. Rowe, G. L. Salmon, A. B. Clegg, and D. Newton (Oxford Univ.). p.145-6 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Measurements were made of the angular correlation of gamma rays and protons from the inelastic scattering of 150 Mev protons from the $J = 2+$ first excited state of C^{12}, observing gamma rays both in and out of the scattering plane. The results enable the effects of distorted waves to be separated and measurements made of individual nuclear matrix elements. (auth)

21469 TWO-QUANTA-EXCHANGE IN THE RATIO OF THE TOTAL (e,N)- TO THE TOTAL (γ,N)-CROSS-SECTION. Rudolf Rodenberg (Universität, Tübingen, Ger.). p.147-8 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

This paper was previously abstracted from the original language and appears in NSA, Vol. 16, abstract no. 12523.

21470 THE BINDING ENERGY OF A Λ PARTICLE IN NUCLEAR MATTER AND THE Λ-N INTERACTION. A. R. Bodmer and S. Sampanthar (The University, Manchester, Eng.). p.151-2 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The potential felt by a Λ in nuclear matter, this being considered as a Fermi gas, was calculated using perturbation theory. Two-body, direct and exchange, Yukawa forces and 3-body forces were considered. The second order contributions, the effect of nuclear pair correlations, and the velocity dependence are all small. The nucleon exchange factor used for the 3-body forces strongly suppresses their effect in nuclear matter. The implications of empirical values of the Λ-potential depth were considered. In particular if the pion-baryon couplings predominate then strongly attractive 3-body forces, corresponding to a larger singlet than triplet 2-body volume integral, are favored. (auth)

21471 SHELL STRUCTURE INVESTIGATION BY ELECTRON SCATTERING ON NUCLEAR PROTONS. Gerhard Jacob and Th. A. J. Maris (Universidade do Rio Grande, Sul Pôrto Alegre, Brazil). p.153-4 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

It is shown that, from angular correlation measurements on energy selected electron-proton pairs resulting from quasi-free scattering, detailed information on the shell structure of light and medium nuclei can be obtained. A calculation for C^{12} was performed, leading to the conclusion that the distortion of the outgoing proton wave

merely reduces the magnitude of the cross section but does not change the shape corresponding to the proton momentum distribution in the relevant shell. This result is expected also to hold for other light and medium nuclei. (auth)

21472 AN ATTEMPT TO DETERMINE THE n-n SCATTERING LENGTH FROM THE REACTION D(n,p)2n. K. Ilakovac, L. G. Kuo, M. Petravić, and I. Šlaus (Inst. "Ruder Bošković," Zagreb). p.157-8 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The high energy part of the proton spectrum from the reaction D(n,p)2n at 14.4 Mev was analyzed using the final state interaction formalism. It is shown that the shape of the high energy part of the spectrum is dependent mostly on the n-n scattering length α_{nn}, and that by varying α_{nn} in the calculation a good fit may be obtained. From this analysis, a value of $\alpha_{nn} = (-22 \pm 2)$ f was obtained. However, this value of α_{nn} is dependent to some extent on the approximations in the theory. (auth)

21473 NUCLEON-NUCLEON INTERACTION. G. Breit, M. H. Hull, Jr., K. E. Lassila, and H. M. Ruppel (Yale Univ., New Haven). p.159-60 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

From the Yale phenomenological phase shift analysis, support of the pseudoscalar theory with pseudoscalar coupling and for the charge independence of nuclear forces was obtained. There is some evidence for the validity of the field theoretical scattering expansion for contributions to high orbital angular momenta L. Indications in favor of spin-orbit effects of other than PSps origin are present. (auth)

21474 ELECTRON-NUCLEUS SCATTERING AND TWO-NUCLEON CORRELATIONS. K. W. McVoy (Rijksuniversiteit, Utrecht). p.161-2 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

If the electrons scattered inelastically by a nucleus are summed appropriately over all energy transfer at fixed momentum transfer, a function S(q) is obtained which depends on the momentum transfer, and which is determined by the Fourier transform of the ground state two-particle correlation function. For O^{16}, it was found that the Pauli or exchange correlations in a shell-model wave function depress S(q) by an amount which reaches a maximum of 30% at q ~ 200 Mev/c, but the further introduction of hard-core correlations does not perturb S(q) from the shell model function by more than 5% at any q. (auth)

21475 FAST NEUTRONS FROM p-d COLLISIONS AT 135 Mev. M. J. Esten, T. C. Griffith, G. J. Lush, and A. J. Metheringham (University Coll., London). p.163-4 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Experimental data on the angular distribution and energy spectra of fast neutrons from inelastic p-d collisions at 135 Mev are presented. These results were obtained from an analysis of cloud chamber photographs showing collisions involving either one or two protons with energy below 10 Mev in the final state. The observed differential cross sections are about twice those predicted in impulse approximation calculations and are almost equal to the free n-p values. The energy spectra have more low energy neutrons than predicted by the theory. (auth)

21476 BINDING ENERGIES OF LIGHT HYPERFRAGMENTS. K. Dietrich (Universität, Frankfurt am Main), R. Folk, and H. J. Mang. p.165-6 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Binding energies of light hyperfragments were calculated on the basis of the independent pair model. The results favor spin zero for H^4_Λ and He^4_Λ and therefore odd K-Λ parity. (auth)

21477 CALCULATION OF THE OPTICAL POTENTIAL WITH THE NUCLEON-NUCLEON PHASE SHIFTS. J. Dabrowski, A. Sobiczewski, and M. Zielinska (Univ. of Warsaw). p.167-8 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The radial dependence of the optical potential for nucleon-nucleus scattering was calculated with the help of the empirical nuclear density. The nucleus is approximated locally by the Fermi model. The equation for the scattering in the nuclear medium was solved approximately, and the optical potential was expressed with the help of nucleon-nucleon phase shifts. In the numerical computations the Signell-Marshak phase shifts were used. The effect of the exclusion principle increased the real part and decreased the imaginary part of the potential in the center of the nucleus. (auth)

21478 THE BOUNDARY CONDITION MODEL OF NUCLEAR FORCES. E. L. Lomon (Massachusetts Inst. of Tech., Cambridge). p.169-70 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The success of the Boundary Condition Model (B.C.M.) as applied to nuclear forces is reviewed. The fact that a boundary condition is a better representation of strong interactions at small distances than a static potential is made plausible by three different arguments. The first is that the high energy of virtual states masks the incoming energy. The second connects the B.C.M. with maximum non-locality consistent with causality. The third concerns the analytic properties of the B.C.M. amplitude and leads to a quantitative program. (auth)

21479 NEUTRON YIELDS FROM THIN TARGETS BOMBARDED BY 32-Mev PROTONS. C. N. Waddell, T. M. Henderson, and P. S. Lewis (Univ. of Southern California, [Los Angeles]). p.171-2 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Neutron yields from thin targets bombarded by 32-Mev protons were measured for 17 elements of natural isotopic abundance. The neutrons were detected in a paraffin moderated array of BF_3 counters enclosed in a 3-foot thick concrete shield. The efficiency of the neutron detection system was determined with a calibrated Ra-α-Be neutron source. Yields from monisotopic targets of Cu and Ni were measured to investigate the sharp decrease in yield previously observed with a thick Ni target. A comparison to the results of a hydrogen bubble chamber experiment is made. (auth)

21480 LOW ENERGY NUCLEON-NUCLEON INTERACTION. D. Amati, E. Leader, and B. Vitale (University Coll., London). p.177-8 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The nucleon-nucleon interaction was studied, for energies below the inelastic threshold, using a method based on the Cini-Fubini approach to the Mandelstam Representation. The spectral functions were calculated by unitarity and include 2π effects. Possible 3π effects are discussed. Numerical calculations indicated that 2π effects are al-

ready considerable at 100 Mev even for fairly large l values. The proton-proton singlet S-phase was calculated assuming only the scattering length, and the effective range obtained agrees very well with the experimental result. Also the general trend of the phase is good at low energies. (auth)

21481 ON (p,p'γ) REACTION WITH EXCITATION OF THE 15.1 Mev LEVEL OF C^{12} BY 150 Mev PROTONS. Do Dang Giu and C. Marty (Laboratoire Joliot-Curie de Physique Nucleaire, Orsay, France). p.179-80 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The correlation function W from the (p,p'γ) reaction with excitation of the ($J^\pi = 1^+$, T = 1) 15.1 level of C^{12} was calculated. With the use of the impulse approximation and of Racah algebra, W is given explicitly in terms of a two-body scattering matrix and nuclear from factors. The agreement is good with experimental data giving W in the plane of scattering. Predictions are made for other arrangements. (auth)

21482 AN EXAMINATION OF THE REACTION $K^- + p \rightarrow \Lambda^0 + \pi^- + \pi^0$ AT 765 Mev/c. D. J. Prowse, D. H. Stork, M. Taher-Zadeh, and H. K. Ticho (Univ. of California, Los Angeles). p.181-4 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

An analysis was made of the K^- + N reaction at 765 Mev/c incident meson momentum in a deuteron bubble chamber. Those two- and one-prong events identified unambiguously as examples of $\Lambda + \pi^- + \pi^0$ were plotted. The abscissae represented the masses of the supposed $Y^*(\Lambda - \pi)$ resonance between the Λ-hyperon and the π^0 or π^- mesons in the neutron reaction or the π^+ or π^- meson in proton reactions. It was established that the Y^{*0} is formed in the neutron reaction. It appeared that the dominant state for the Y^* formation is the T = 1 state of the $K^- - p$ system. (M.C.G.)

21483 THE SIGN OF THE Σ^+-HYPERON NUCLEAR POTENTIAL. H. E. Fish and D. J. Prowse (Univ. of California, Los Angeles). p.185-8 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

A search was made for hyperon (Σ^+) interactions with nuclei present in nuclear emulsion. About 6000 K^- meson stars were analyzed and 6 hyperon (Σ) interactions were identified. These results were combined with others to give a total of 11 events. Eight of these were interactions of Σ^+ hyperons and 3 were interactions of Σ^- hyperons. The effects of Fermi motion and nuclear potential were separated. Results indicated an attractive potential of 20 Mev. (M.C.G.)

21484 EXCITATION FUNCTIONS FOR (p,pn) REACTIONS. M. Gusakow, G. Albouy and N. Poffe (Laboratoire Joliot-Curie de Physique Nucléaire, Orsay, France). p.189-90 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Excitation functions for (p,pn) reactions were measured in the energy range of 20 to 155 Mev, for the target nuclei F^{19}, Na^{23}, Mn^{55}, Y^{89}, Cs^{133}, and Au^{197}. Results of theoretical calculations agree with experimental cross sections in the low energy (compound nucleus) region provided pairing energies in the level density formula are used. At higher energies, the differences between experimental and theoretical cross sections are very important, and seem to increase with the atomic mass of the target, except for Au. (auth)

21485 EXCITATION FUNCTIONS FOR (p,xn) REACTIONS ON GOLD FROM 40 TO 155 Mev. G. Albouy, M. Gusakow, and N. Poffe (Laboratoire Joliot-Curie de Physique Nucléaire, Orsay, France). p.191-2 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Mercury isotopes of mass between 197 and 190 were separated by electromagnetic deflection. Results were normalized by Hg^{195}, appearing at all energies, the excitation function of which was determined otherwise. Comparison with theoretical computations based on Weisskopf's analytical method for the evaporation stage and Monte Carlo results for the direct interaction stage showed good agreement at 155 Mev. A discrepancy seemed to appear at 80 Mev. (auth)

21486 PROTON-PROTON POLARIZATION BETWEEN 30 Mev AND 100 Mev. P. Christmas (Oxford Univ.). p.193-4 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The polarization in proton-proton scattering between about 30 and 100 Mev was studied by a double-scattering experiment using the polarized proton beam from the Harwell 110 in. synchrocyclotron. The beam energy was reduced to the required values by suitable absorbers, and energy selection was by an anticoincidence arrangement in conjunction with telescope absorbers. A solenoid was used to process the beam polarization through ±180°. (auth)

21487 BINDING-ENERGIES OF PROTON STATES IN LIGHT NUCLEI. H. G. Pugh (Atomic Energy Research Establishment, Harwell, Berks, Eng.). and K. F. Riley. p.195-6 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

To trace out the development of nuclear shell structure, the (p,2p) reaction was studied at 150 Mev for a variety of nuclei up to calcium. Angular correlation measurements near the conditions for zero momentum transfer enable each state to be classified according to whether its orbital angular momentum is zero or non-zero. The variation of binding energy with atomic weight is qualitatively in agreement with that expected in an optical model potential. (auth)

21488 EMISSION OF ENERGETIC DEUTERONS AND TRITONS AND THE EXISTENCE OF CORRELATIONS IN NUCLEI. P. Radvanyi (Faculté des Sciences, Orsay, France), J. Genin, I. Brissaud, C. Detraz, P. Benoist, R. Pasquier, J. Yoccoz, and d'Hulst. p.197-8 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Analysis of the energy spectra of protons, deuterons, and tritons emitted at 15, 30, and 60° from carbon and gold bombarded by 154 Mev protons is expected to give information on correlations between nucleons. Emission of these particles can result from different mechanisms. Calculations on indirect pick-up indicated that this process is important enough to require its contribution to be well known for a correct estimate of the magnitude of the knock-out mechanism, the latter process implying the existence of correlations. (auth)

21489 MOMENTUM DISTRIBUTION OF PROTONS IN ^{12}C NUCLEUS FROM p,2p REACTION AT 155 Mev. J. P. Garron, J. C. Jacmart, M. Riou, and Ch. Ruhla (Laboratoire de Physique Nucléaire, Orsay, France). p.201-3 of "Proceedings of the Rutherford Jubilee International Con-

ference, Manchester, 1961." New York, Academic Press Inc., 1961.

From angular correlation measurements with proton pairs resulting from the $C^{12}(p,2p)B^{11}$ reaction information was obtained about the momentum distribution of p and s protons in the nucleus. (auth)

21490 A SUMMARY OF BINDING ENERGY DATA FROM HYPERNUCLEI DECAYING BY π^- EMISSION. N. Crayton (Univ. of Chicago), R. Levi Setti, M. Raymund, O. Skjeggestad, D. Abeledo, R. G. Ammar, J. H. Roberts, and E. H. Shipley. p.205-6 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Statistics on binding energies of hypernuclei decaying by meson (π^-) emission are presented. All binding energies were calculated for $Q_A = 37.58 \pm 0.15$ Mev. (M.C.G.)

21491 PAIRING CORRELATIONS IN NUCLEI. B. H. Flowers (Univ. of Manchester, Eng.). p.207-18 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Studies were made that show how to project out of the Bardeen-Cooper-Schrieffer wave function ϕ a function corresponding to a definite number of particles. The energy expression was minimized by integrals taken about the origin and evaluated by the method of steepest descents. It was concluded that the overlap integrals between the exact wave functions and the projected wave functions of a given number of particles obtained from Bayman's procedure are greater than 98%. The pairing of the neutron and proton system and generalization of the Bardeen method to this situation is discussed. (M.C.G.)

21492 EXPERIMENTAL EVIDENCE FOR COLLECTIVE OSCILLATIONS. Bernard L. Cohen (Univ. of Pittsburgh). p.219-31 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Two-phonon triplets and the theory of collective oscillations are discussed. The present status of experimental investigations is reviewed. Techniques for studying collective oscillation levels and results on 2+ states are described. Experimental results were compared with theory. Problems in determining collective levels in odd nuclei are outlined. (M.C.G.)

21493 THEORY OF COLLECTIVE OSCILLATIONS. G. E. Brown (NORDITA, Copenhagen). p.232-51 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The connection between collective oscillations and single-particle excitations is discussed. Odd-parity vibrations are described. Shell-model and generalized shell-model calculations are presented. Vibrations excited by scattering are discussed. (M.C.G.)

21494 COLLECTIVE VIBRATIONS IN EVEN-EVEN NUCLEI. V. K. Thankappan and S. P. Pandya (Physical Research Lab., Ahmedabad, India). p.253-4 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The energy levels of even-even nuclei were calculated in detail on the basis of the unified model. Si^{30} was chosen as a test case. The nuclear forces between the last two neutrons, $s_{\frac{1}{2}}$, $d_{\frac{5}{2}}$ configuration mixing and interactions with the quantized harmonic vibrations of the Si^{28} core were taken into account. It was found that a low-lying 0^+ excited state can be obtained, in agreement with the experimental observation of such levels in Mg^{26}, Si^{30}, and S^{32}. For a reasonable choice of parameters, the first excited state is 2^+, followed by a close doublet 0^+, 2^+ and above that a group of levels 0^+, 2^+, 4^+, and 1^+. (auth)

21495 SINGLE PARTICLE NEUTRON LEVELS IN THE ZIRCONIUM REGION. B. L. Cohen, E. W. Hamburger, and R. E. Price (Univ. of Pittsburgh). p.257-8 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Single particle neutron levels in Sr^{89}, Zr^{91}, Zr^{93}, and Zr^{95} were located and identified, and occupation numbers (V_j^2) were determined. All evidence indicated that in the unperturbed single particle states, the $d_{\frac{5}{2}}$ lies far below the $g_{\frac{9}{2}}$ which even lies well above the $s_{\frac{1}{2}}$ and near the $d_{\frac{3}{2}}$. This is very different from the situation in the A = 120 region where the $g_{\frac{9}{2}}$ lies very close to the $d_{\frac{5}{2}}$, with both being far below the $s_{\frac{1}{2}}$ and $d_{\frac{3}{2}}$. (auth)

21496 CLUSTER MODEL CALCULATIONS IN LIGHT NUCLEI. K. Wildermuth (Florida State Univ., [Tallahassee]), Y. C. Tang, F. C. Khanna, and L. D. Pearlstein. p.259-60 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

A variational procedure was used to calculate the energies of the various levels in the light nuclei with A = 5, 6, 7, 8. The trial wave functions were chosen according to the prescription of the cluster model. It was found that to produce satisfactory results, it is in general necessary to depart from the usual shell model picture. Also, it was found that the 7.47 Mev level in Li^7 is definitely a member of the ^4P multiplet, with the experimentally undetected $F_{\frac{5}{2}}$ level lying at an excitation of about 6 Mev. Furthermore, the results indicated that the existence of a broad positive parity level at 6.54 Mev in Li^7 as indicated by some experiments is highly questionable. (auth)

21497 GAMMA-TRANSITIONS IN ^{32}S. S. L. Andersen (Universitet, Oslo, Blindern, Norway). p.261-2 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Six resonances in the reaction $P^{31}(p,\gamma)S^{32}$ were measured. By means of single and coincidence spectra, measured with two 5 × 5 in. NaI(Tl) crystals, the disintegration schemes and the relative intensities were determined. (auth)

21498 THE ENERGY LEVELS OF Na^{23}. D. W. Braben, L. L. Green, and J. C. Willmott (Univ. of Liverpool). p.265-6 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The $Ne^{22}(p,\gamma)Na^{23}$ reaction was studied at 5 resonances and the spin and parities of a number of low-lying states determined. The results were interpreted using the collective model, which gives a fair description of the observed level scheme and measured branching ratios up to about 5 Mev using three bands with $K = \frac{1}{2}, \frac{3}{2}$, and $\frac{5}{2}$. (auth)

21499 COLLECTIVE CHARACTER OF THE 2.33 Mev, 3- STATE IN Sn^{116}. O. Hansen and O. Nathan (Universitet, Copenhagen). p.267-8 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The levels at 1.28 and 2.23 Mev in Sn^{116} were excited by inelastic scattering of α particles. The de-excitation γ rays were observed in coincidence with backwards scattered projectiles. From γ angular distributions the most likely spin assignment for the 2.23 Mev state is 3. The parity is then negative, since the level is populated in Coulomb excitation. The reduced electric octupole transition probability B(E3) was found to be $(0.57 \pm 0.16) \times 10^{-}$

e^2 cm^6, which is 100 ± 30 times the single particle estimate. (auth)

21500 INELASTIC SCATTERING OF 150 Mev PROTONS FROM ^{40}Ca. D. J. Rowe, A. B. Clegg, G. L. Salmon, and D. Newton (Oxford Univ.). p.271-2 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Observations are reported of the states of Ca^{40} excited in inelastic scattering of 150 Mev protons, together with gamma-ray angular correlations to determine spins and parities. It is noted that there are two states with J = 3 − strongly excited, at 3.73 and 4.48 Mev. (auth)

21501 EFFECTIVE INTERACTIONS IN DEFORMED NUCLEI. I. Unna (Weizmann Inst. of Science, Rehovoth, Israel). p.273-4 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Energy levels in O^{17}, F^{18}, F^{19}, and Ne^{20} were calculated. The wave functions for the different states were generated from intrinsic deformed potential wave functions. The wave functions for which best agreement was obtained are similar to those obtained by Redlich. No a priori assumptions were made on the form of the two body forces. These were adjusted to give best fit with experiment. The agreement obtained between the calculated and experimental energy levels is good. (auth)

21502 SIMPLE MODELS OF MANY-PARTICLE SYSTEMS. H. J. Lipkin (Weizmann Inst. of Science, Rehovoth, Israel). p.275-6 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

A number of simple soluble models are proposed for testing the various methods and approximations used in treating many-body systems. The models have several degenerate shells and residual interactions possessing symmetry properties making possible an exact solution. The regions of validity of different methods can be determined by comparing results with the exact solution as a function of the parameters characterizing the problem. One particular model is presented in detail and can be used for testing particle-hole interactions and excitations. The group-theoretical basis of the symmetries underlying the models is discussed. (auth)

21503 NUCLEAR MODELS AND THE TENSOR OF INERTIA. W. Macke and R. Lenk (Technische Universität, Dresden). p.277-8 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Rotational states for heavy nuclei were determined under most general suppositions by a variational principle with subsidiary condition. They are non-stationary and contribute the cranking model terms $\omega\theta\omega/2$ and $\theta\omega$ to energy and angular momentum. The tensor of inertia comes out in a form $\theta = -\langle\partial^2 B/\partial\omega\cdot\partial\omega\rangle$ and is degenerated as $e\theta = e$, e being the rotation axis of any model operator H°. (auth)

21504 INELASTIC SCATTERING FROM COLLECTIVE NUCLEI. A. V. Cohen (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.), J. A. Cookson, W. Darcey, and N. W. Tanner. p.279-80 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Inelastic scattering of 11 Mev protons and deuterons was observed to excite both the first and second rotational states of Sm^{154} and four excited states of Se^{78}. It is suggested that three of the Se^{78} excited states may be the expected vibrational triplet. (auth)

21505 NUCLEAR g VALUES OF THE FIRST EXCITED STATES OF Sm^{152}, Gd^{154}, AND Gd^{156}. R. W. Bauer and M. Deutsch (Massachusetts Inst. of Tech., Cambridge). p.283-4 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The nuclear g values of the first excited rotational 2+ states were found to be 0.351 ± 0.025 for Sm^{152}, 0.365 ± 0.035 for Gd^{154}, and 0.33 ± 0.09 (preliminary value) for Gd^{156}. The perturbation of the angular correlation of gamma ray cascades proceeding through these states was studied. It was found that the perturbations in aqueous solutions can be decoupled by magnetic fields. The transverse decoupling experiments yielded a magnetic hyperfine structure coupling constant of 26.4 ± 5 Mc/sec for Gd^{154} and 23.9 ± 4.3 Mc/sec for Gd^{156}. (auth)

21506 ENERGY LEVELS OF Gd^{156}. G. T. Ewan, R. L. Graham, and J. S. Geiger (Atomic Energy of Canada Ltd., Chalk River, Ont.). p.287-8 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The energy levels of Gd^{156} fed in the β-decay of Eu^{156} were studied with the Chalk River high resolution β spectrometer. The relative quantum transition probabilities from the 1154 kev (2+) level are consistent with its description as a K = 2 gamma-vibrational level having a small admixture of K = 0. When interaction between the 1- levels at 1242 and 1366 kev is taken into account the relative transition probabilities from these levels are consistent with K-assignments of 0 (1242 kev) and 1 (1366 kev). Five low spin (1 or 2) positive parity levels were observed between 1960 and 2210 kev. These may be either single particle or collective states. (auth)

21507 ON THE EXACT SOLUTIONS FOR THE PAIRING PLUS QUADRUPOLE-QUADRUPOLE INTERACTIONS. M. Moshinsky (Universidad, Mexico City). p.289-90 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

A nuclear model in which the nucleons move in a shell model potential and interact through pairing plus quadrupole-quadrupole forces is discussed. Most analyses of this problem make approximations of one type or another. Using a new approach to supermultiplet theory, exact calculations are reported in the 0p, 1s−0d, and higher shells. Comparisons between results and those of approximate calculations are given. (auth)

21508 CHARGED LIQUID DROP WITH HIGH ANGULAR MOMENTUM. B. C. Carlson and Pao Lu (Ames Lab., Ames, Iowa). p.291-2 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961. (IS-366)

The deformation of a compound nucleus with high angular momentum, as encountered in heavy-ion reactions, was calculated with a liquid-drop model. Subject to the constraint of ellipsoidal shape, the collective (surface, Coulomb, and rotational) energy is a minimum for oblate spheroids below a critical angular momentum and for triaxial ellipsoids above this critical value. The triaxial shapes are closely analogous to the Jacobi ellipsoids found in the related problem of a rotating liquid mass held together by gravitation. (auth)

21509 PAIRING FORCES NEAR CLOSED SHELLS. M. Bolsterli and J. A. Evans (Univ. of Minnesota, Minneapolis). p.293-4 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

A non-canonical transformation facilities diagonalization of a B.C.S. type Hamiltonian for nuclei having two more, or two less nucleons than a doubly magic nucleus. Results calculated for F^{18} and N^{14} showed a better over-all fit to binding energies than did a conventional shell model based on the same interacting configuration. (auth)

21510 THE GIANT DIPOLE RESONANCE IN O^{16}. N. W. Tanner, G. C. Thomas, and E. D. Earle (Oxford Univ.). p.295-6 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961. New York, Academic Press Inc., 1961.

The photodisintegration of O^{16} was investigated with fine energy resolution using the inverse reaction $N^{15}(p,\gamma)O^{16}$. An excitation of 26 Mev was reached, which presumably includes all the dipole states. The agreement with shell model calculations is good. (auth)

21511 THE GIANT DIPOLE RESONANCE IN Ca^{40}. N. W. Tanner, G. C. Thomas, and E. D. Earle (Oxford Univ.). p.297-8 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The giant dipole resonance in Ca^{40} was studied through the inverse reaction $K^{39}(p,\gamma)Ca^{40}$. The resonance was found, as expected from the predictions of Brown et al., and the general systematics of dipole resonances, at an excitation of 19.5 Mev and with a width of 3.5 Mev. There is evidence for structure within the resonance which cannot be directly interpreted in terms of Brown's predictions. (auth)

21512 MANY-BODY PERTURBATION IN A SOLUBLE MODEL. A. Glick, H. J. Lipkin, and N. Meshkov (Weizmann Inst. of Science, Rehovoth, Israel). p.299-300 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

A model with particles in two shells with a monopole-monopole force was solved exactly and also by the following many-body perturbation methods: ordinary second order perturbation theory and summation of bubble graphs to all orders (RPA). Results indicated that although the bubble sum should be a good approximation when the number of particles is large, it is not so good when the number is small, as in light nuclei. Exact results for systems of up to 8 particles indicated that second order perturbation theory gives better results than the bubble sum, and extrapolation indicates that this should hold up to about 20 particles. (auth)

21513 COLLECTIVE MOTION IN HIGHLY EXCITED NUCLEI. Henry W. Newson (Duke Univ., Durham, N. C.). p.301-2 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The peaks in neutron resonance spacings near the numbers 50, 82, and 126 are ascribed to vibrational bands superimposed on a definite number of stable configuration states. The most stable states may be identified and counted with the aid of the shell model. A plot of the reciprocal of this count against A has sharp maxima at these numbers and is otherwise strikingly similar to a plot of reduced neutron resonance spacings. The stability of the orbits in the stable configuration states is ascribed to the pairing energy which is expected to be weak for the highly distorted nuclei far from the magic numbers. This expectation was confirmed by the fact that agreement between calculation and experiment breaks down between A = 155 and 195. (auth)

21514 INELASTIC SCATTERING OF 43 Mev α-PARTICLES BY MEDIUM-WEIGHT NUCLEI. R. Chaminade, M. Crut, H. Faraggi, D. Garetta, J. Saudinos, and J. Thirion (Centre d'Études Nucléaires, Saclay, France). p.304-5 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Excitation of collective levels in some isotopes of Fe, Ni, Cu, and Zn was studied through angular distributions of α particles in (α,α') reactions. For odd-even isotopes, for quadrupole and octupole excitations, the expected splitting due to coupling between odd nucleon and even-even core vibration was found. In the two-phonon case of excitation, for even-even nuclei, evidence was found for a double excitation process, correlated with the purity of the vibrational character of the states involved. (auth)

21515 FURTHER EVIDENCE FOR THE (2I + 1) RULE IN THE $Al^{27}(d,\alpha)Mg^{25}$ REACTION. S. Hinds (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.), R. Middleton, and A. E. Litherland. p.305-6 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The possibility that the total cross section of the individual groups from a compound nucleus reaction might be proportional to (2I + 1) was investigated. For this purpose the $Al^{127}(d,\alpha)Mg^{25}$ reaction was studied at an incident energy of 10 Mev with the Aldermaston multi-channel magnetic spectrograph. Angular distributions of 44 alpha groups were measured over the range 5 to 175° and from these total cross sections were calculated. For the states of known spins the (2I + 1) rule is obeyed surprisingly well and it is possible that other spins may be predicted to within one unit of angular momentum. (auth)

21516 HEAVY ION COULOMB EXCITATION OF Pd^{108} AND Pd^{110}. B. M. Adams, D. Eccleshall, and M. J. L. Yates (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). p.307-8 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

An attempt was made to excite the two-phonon triplet (0+, 2'+, 4+) in Pd^{108} and Pd^{110} using oxygen ions from the Aldermaston Tandem accelerator. The yields of γ rays in coincidence with the $2^+ \rightarrow 0^+$ γ rays and with backscattered ions were measured. The angular correlation of a 0.620 Mev γ ray in Pd^{108} with the scattered oxygen ions required the excitation of a 4+ state at about 1.05 Mev and was consistent with a contribution from the known 0+ state at this energy, of the magnitude predicted by the ideal vibrational model. Similarly Pd^{110} had a 4+ level at 0.915 Mev. (auth)

21517 OXYGEN ION COULOMB EXCITATION IN Ru^{102}, Ru^{104}, Pd^{108}, Cd^{112}, AND Cd^{114}. M. J. L. Yates, D. Eccleshall, and B. M. Adams (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). p.309-10 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The second 2+ and 4+ states in Ru^{102} (1.10 Mev), Ru^{104} (0.89 Mev), Pd^{108} (1.3 and 1.228 Mev), Cd^{112} (1.29 and 1.40 Mev), and Cd^{114} (1.21 and 1.285 Mev) were excited by bombarding targets of the separated isotopes with oxygen ions accelerated in the Aldermaston Tandem accelerator. Where the existence of a 4+ level was not previously known it was inferred from a comparison of the gamma-gamma coincident yield with those in Pd^{108} and Pd^{110}. Preliminary values for the ratio of the reduced E2 transition probabilities $B_{E2}(2+ \rightarrow 4-)/B_{E2}(0+ \rightarrow 2+)$ were obtained. (auth)

21518 THE ALPHA DECAY SCHEME OF 152 YEAR Am^{242m}. F. Asaro, M. C. Michel, S. G. Thompson, and

I. Perlman (Univ. of California, Berkeley). p.311-12 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961. (UCRL-9758)

Detailed nuclear spectroscopy studies on the alpha decay of Am^{242m} showed many low-lying energy levels which were interpreted in terms of a few rotational bands. The predominant alpha decay is of the unhindered type observed in the even-even and odd-mass nuclides. The rotational bands can be interpreted in terms of the Nilsson orbitals associated with odd-mass nuclides as can the moments of inertia, and the interband alpha and gamma-ray transitions probabilities. There is also evidence of an appreciable Coriolis interaction between different rotational bands having the same Nilsson orbital assignments (one of which is $K = 1/2$). (auth)

21519 THE 2·2 Mev LEVEL IN Al^{27}. E. B. Paul, J. E. Evans, and J. H. Montague (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.313-14 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The branching ratio to the 2.2 Mev level of Al^{27} from the Si^{27} ground state was studied by detecting the de-excitation gamma rays from this level. The ratio, (2.2 Mev γ rays/ β^+(all levels)), was found to be (6 ± 3) % which implies that the branching is much larger than is predicted by the Nilsson model. (auth)

21520 THE COLLECTIVE STATES OF O^{16} AND C^{12}. Vincent Gillet (Centre d'Études Nucléaires, Saclay, France) and Nicole Vinh Mau. p.315-16 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The 0^-, 1^-, 1^+, 2^+, 2^-, 3^-, T = 0, T = 1 states of O^{16} and C^{12} were computed with the Green function formalism using the ring diagrams approximation. An effective two-body Gaussian interaction was used together with a Rosenfeld force or a Soper force. A brief discussion of some of the results as compared to the experimental situation is presented. (auth)

21521 THE COUPLING OF THE K = 2 BAND TO THE GROUND STATE ROTATIONAL BAND IN DEFORMED EVEN NUCLEI. O. B. Nielsen (Universitet, Copenhagen). p.317-18 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The parameter z describing the coupling of the K = 2 band to the ground state band was obtained for 12 isotopes from an analysis of the E2 transition ratios. The admixed amplitudes are determined from z and the E2 transition probabilities found by Coulomb excitation of the 2^+ states in the two bands, and are used for calculating the energy shifts. It was concluded that the deviations from the I(I + 1) dependence of the energies in the ground state band are not mainly due to coupling to the K = 2 band. (auth)

21522 THE SPECTRUM OF TWO-PARTICLE EXCITATIONS IN NUCLEI. James E. Young (Universitet, Copenhagen). p.319-20 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

It was considered that the spectrum of single particle excitations, comprised in the energy dependence of the optical potential, undergoes systematic departures, e.g., as a function of mass number for fixed energy. Corrections to this spectrum were sought in the modifications introduced by the existence of two-particle excitations. These may be of two types generally classified according to whether particles scatter each other or go into a bound, correlated state. If the latter situation was considered phenomena were encountered having to do with collective motions of the nuclear system. The excitation spectrum was that for a vibrating system. For example, the excitation spectrum of the A + 1 particle system achieved through charge exchange (n,p) or inelastic scattering (n,n′) upon an odd mass nucleus with a single valence nucleon is discussed. The extension to other odd-A systems is straightforward. The problem was done in a self-consistent manner whereupon the collective state appears as an intermediate one in the reaction process. Although there is energy transfer among all of the nuclear constituents, it is a situation intermediate between that of the higher excited, thermodynamic, compound configuration and the two-particle compound state characterized as having positive energy for the constituents undergoing forward scatterings to infinite order. The two-particle interaction operator which is effective in giving the (n,n′) and (n,p) matrix elements may be expressed in terms of the two-particle Green's function (or a closely related operator). The latter contains a pole in energy at the position of the bound state. It is possible to obtain the interaction operator as a sum of resonant and non-resonant terms. The former term contains the single-particle spectrum of excitations and the latter the correction to this owing to the presence of the bound state. (auth)

21523 SYSTEMATICS OF OCTUPOLE STATES IN NUCLEI. G. W. Farwell (Universitet, Copenhagen). p.321-2 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York Academic Press Inc., 1961.

The dependence of excitation energy on A was examined for established collective octupole states in even-even nuclei from C^{12} to U^{238}. Other negative parity states and certain states strongly excited in inelastic scattering by odd and even nuclei were also studied. Special effects include isotopic differences, shell structure effects, odd-even differences, and trends in the heavy elements. (auth)

21524 THE GIANT E1 RESONANCE FOR DEFORMED NUCLEI. N. K. Glendenning, S. G. Nilsson, and J. Sawicki (Univ. of California, Berkeley). p.323-6 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

A random-phase-approximation calculation was attempted for C^{12} and Mg^{24}, which was assumed to have stable distortions. A residual interaction of finite range and with two different exchange mixtures was employed. The effects of ground-state correlations on C^{12} were found not to change appreciably either the excitation energies or the distribution of E1 strength. Some effect on sum rules was observed. Calculations were completed for Mg^{24} only, with ground-state correlation effects neglected. Results showed one main peak at upper end of K = 1 spectrum, another about 6 Mev lower, in middle of the K = 0 spectrum. (auth)

21525 ENERGY LEVELS OF IODINE ISOTOPES. B. Banerjee and K. K. Gupta (Tata Inst. of Fundamental Research, Bombay). p.327-8 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Energy levels of I^{127} and I^{129} were calculated on the basis of an intermediate coupling model. Data are presented in tabular form. (M.C.G.)

21526 NUCLEAR MOMENTS OF STATES OF Dy^{161}. R. Bauminger, S. G. Cohen, A. Marinov, and S. Ofer (Hebrew Univ., Jerusalem). p.329-32 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Hyperfine Zeeman splittings in the recoil-free absorption spectrum of the 26 kev γ ray from Dy^{161} situated in dysprosium iron garnet were observed. At 85°K, the magnetic hyperfine interactions ($g\mu_n H_{eff}$) of the ground state and first excited state of Dy^{161} are (-400 ± 40) and $(+455 \pm 40)$ Mc/s, respectively. The electric quadrupole interactions ($eqQ/4$) at this temperature are (120 ± 30) and (90 ± 30) Mc/s, respectively. From earlier measurements on the ground state H_{eff} (85°K) = 3.5×10^5 oe, and $(+0.42 \pm 0.08)$ nm for the magnetic moment of the first excited state were obtained. A theory of the origin of the large temperature dependent quadrupole interaction is outlined. Preliminary results relating to the second excited state of Dy^{161} are mentioned. (auth)

21527 EVIDENCE FOR A NEW FIRST-EXCITED STATE IN Mg^{26}. G. Dearnaley and A. T. G. Ferguson (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.335-6 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

In the course of an experiment to study the background produced by neutron-induced processes in a silicon semiconductor which was designed for charged particles, studies were made of the yield from the detector when exposed to neutrons of closely defined energy between 5 and 8 Mev. A number of peaks was observed in the spectrum, all but one of which was assigned to (n,p) and (n,α) reactions in silicon. The remaining peak constitutes evidence for a new first excited state in Mg^{26} at an excitation of 1.33 ± 0.02 Mev. (auth)

21528 THE STRUCTURE OF THE NUCLEAR SURFACE. D. H. Wilkinson (Oxford Univ.). p.339-56 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Methods for investigating the nuclear surface are discussed. Three sources of evidence as to the texture of the surface are described: collision phenomena, reduced widths for complex particles, and non-mesonic K^--meson adsorption. The question of the existence of a tail to the nucleus, the neutron-proton ratio, and momentum distribution in the nuclear surface is also discussed. (M.C.G.)

21529 OPTICAL MODEL ANALYSES OF THE NUCLEAR SURFACE. P. E. Hodgson (Oxford Univ.). p.357-64 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The form of the optical potential in elastic scattering processes was studied by use of an optical model to learn more about nuclear structure. Data indicated that the absorbing part of the optical potential is predominantly concentrated in the surface region. This is in general agreement with the theoretical calculations based on the known characteristics of the nucleon-nucleon interaction. (M.C.G.)

21530 THE MANY-BODY PROBLEM. J. S. Bell (CERN, Geneva). p.373-85 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The status of the Brueckner formalism as an approach to the problem of deriving nuclear properties from realistic two-body forces is outlined. The nuclear matter theories of Mohling and Puff are discussed. An approach to the many-body problem in which the hard core is removed by canonical transformation is described, and its advantages are discussed. (M.C.G.)

21531 THE MOMENTUM DISTRIBUTION IN THE NUCLEUS AND ITS IMPLICATIONS FOR INDEPENDENT PARTICLE THEORIES. Keith A. Brueckner (Institute for Defense Analyses, Washington, D. C.). p.386-91 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Experimental and theoretical evidence on the momentum distribution or correlation structure of the nucleus, and its relation to nuclear models, is summarized. (M.C.G.)

21532 NEUTRON-PROTON INTERACTIONS IN Li^6. S. K. Shah and S. P. Pandya (Physical Research Lab., Ahmedabad, India). p.393-4 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The nature of the nuclear interaction in the s- and d-states of relative angular momenta in Li^6, determined from the known triplet and singlet S- and D-states, was obtained for direct comparison with the free two-nucleon interactions in even states. It was concluded that the central interactions are attractive but weaker and longer ranged, whereas the tensor and two-body spin-orbit forces are very similar to those observed in free nucleon-nucleon interactions. (auth)

21533 THEORETICAL ALPHA DECAY HINDRANCE FACTORS. H. J. Mang (Universität, Heidelberg) and J. O. Rasmussen. p.397-8 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Reduced alpha hindrance factors of deformed nuclei were calculated. The calculation is based on Nilsson's nucleonic wave functions. The effect of a pairing force between nucleons outside closed shells was taken into account. The theoretical results obtained for alpha emitters in the mass range from Th^{228} to Fm^{250} agree well with the experimental hindrance factors. (auth)

21534 THE IMPORTANCE OF A TWO STAGE DECAY MODE OF K^- MESIC ATOMS. J. R. Rook (Oxford Univ.). p.399-400 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

An estimate was made of the relative probabilities of two modes of decay of K^- mesic atoms in nuclear emulsion. The processes considered are the direct $K^- + P \rightarrow \Sigma\pm + \Pi\mp$ and the process where the meson scatters from a single nucleon into a bound state. The probabilities were calculated in the lowest order of perturbation theory. It was found that the direct process predominates over the scattering process by a factor of over 100. It was concluded that the scattering process does not explain the relatively high observed frequency of decays involving two nucleons. (auth)

21535 VELOCITY DEPENDENT NUCLEAR FORCES AND THEIR EFFECT IN NUCLEAR MATTER. A. M. Green (Univ. of Birmingham, Eng.). p.401-2 of "Proceedings of the Rutherford Jubilee International Conferences, Manchester, 1961." New York, Academic Press Inc., 1961.

An attempt was made to replace the effect of the hard core present in current nucleon-nucleon potentials, by using a strongly velocity dependent non-singular potential. This potential, adjusted to fit the two nucleon scattering data, was used to evaluate the average binding energy per particle of infinite nuclear matter applying ordinary perturbation theory up to first order. The magnitude of the second order term was also estimated. (auth)

21536 ENERGY LEVEL SELECTION IN NEUTRON TRANSFERS TO LEAD ISOTOPES. T. L. Watts and J. A. McIntyre (Yale Univ., New Haven). p.403-4 of "Proceed-

ings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The transfer of a neutron from the N^{14} nucleus to the Pb^{207} nucleus and to the Pb^{208} nucleus was investigated experimentally at an energy (112 Mev) considerably above the Coulomb barrier energy (70 Mev). It was found that the transferred neutrons seldom combine with the Pb^{207} nucleus to produce a ground-state Pb^{208} nucleus, while, ground-state Pb^{209} nuclei are often produced by transfer of a neutron to the Pb^{208} nucleus. A suggestion by Breit accounts for this behavior in terms of the high angular momentum of the transferred neutron and the spins of the Pb and N nuclei involved. (auth)

21537 MONTE CARLO CALCULATIONS OF THE ALPHA PARTICLE GROUND STATE. M. H. Kalos (United Nuclear Corp., White Plains, N. Y.). p.405-6 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The Schrödinger equation for the ground state of an N particle system may be written as a 3N dimensional integral equation. If the binding energy is assumed known, leaving the strength of the potential to be determined; if central forces are used; and if there is no requirement for anti-symmetrization, then the kernel is positive and integrable. The integral equation is readily solved by Monte Carlo methods. This technique was applied to the alpha particle with simple phenomenological pair potentials. (auth)

21538 OPTICAL MODEL ANALYSES OF He^3 ELASTIC SCATTERING. P. E. Hodgson (Oxford Univ.). p.407-8 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The optical model potentials fitting the experimental data on the elastic scattering of 29 Mev He^3 by a range of nuclei were tabulated and compared. On the whole the potentials decreased with increasing target size, and the surface diffuseness parameter showed some correlation with nuclear shell structure. Calculations were made on the relative importance of different parts of the nuclear potential, and it is shown that the interior of the potential has negligible effect on the elastic scattering. (auth)

21539 OPTICAL MODEL ANALYSIS OF POLARIZATION IN NEUTRON SCATTERING AT 2.09 Mev. P. E. Hodgson (Oxford Univ.). p.409-10 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The data of Cranberg on the polarization of 2.09 Mev neutrons elastically scattered by a range of nuclei were analyzed during the optical model. The over-all features of the measurements are given by a Saxon-Woods potential with $U = -45$ Mev, $W = -3$ Mev, $U_s = 3$ Mev $-f^2$, $r_0 = 1.3$ f, and $a = 0.65$ f. (auth)

21540 ON THE SHAPE OF THE IMAGINARY PART OF THE OPTICAL MODEL POTENTIAL. M. A. Melkanoff (Univ. of California, Los Angeles), D. S. Saxon, and J. S. Nodvik. p.411-12 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

An indication of the shape of the imaginary part of the optical model potential was obtained from analyses of p-C and p-Cu scattering at intermediate energies. Absolute minima were found in the χ^2 deviation between calculated and experimental angular distributions. The shape of the χ^2 surface near the minimum provided information on the acceptable range of parameters. For carbon, the volume absorption was confined to a shell less than one fermi thick. For copper, the volume absorption at 17 Mev appeared to be rather less than 5 Mev. (auth)

21541 THE NUCLEAR MANY-BODY PROBLEM IN THE BOUNDARY CONDITION MODEL. E. L. Lomon (Massachusetts Inst. of Tech., Cambridge). p.413-14 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The Boundary Condition Model is applied to the nuclear many-body problem. The successful application of the B.C.M. to the nuclear two-body problem raises the question of its predictions for nuclear binding energy, etc. A pseudo-potential is used to exactly replace the boundary condition after which Brueckner equations can be applied, modified for 'hole-hole' interactions. The simple solution of the short-range interaction allows for a reasonable numerical program. The simplicity of the short-range contribution is further utilized to examine the size of various 'correction' terms. (auth)

21542 THE MANY-BODY PROBLEM OF O^{16}. H. S. Koehler (Univ. of California, Los Angeles). p.415-16 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The nuclear many body problem of O^{16} was investigated by the reaction matrix theory. The single particle wavefunctions were taken to be those of a harmonic oscillator. The reaction matrix was calculated by the separation method. The two-nucleon interaction was represented by a spin-independent potential of exponential shape and with a hard core. Only the first order term and the dispersion correction was calculated. A minimum in the total energy of -2 Mev/A (exp. $-$ 8 Mev/A) at a root mean square radius of 2.74 fermis (exp. 2.57 fermis) was obtained. (auth)

21543 CLUSTER MODEL INTERPRETATION OF ENERGY WIDTH VARIATIONS NEAR THRESHOLD. G. C. Phillips and T. A. Tombrello (Rice Univ., Houston, Tex.). p.417-18 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The cluster model predicts that the level reduced width, or the strength function for nuclear states, should attain large values near threshold and diminish above threshold in a calculable manner. Measurements of hundreds of proton elastic scattering resonances for the targets Cr^{50}, Cr^{52}, Fe^{54}, and Ni^{58} in the energy region 2 to 5 Mev have allowed comparison to the model; these give good agreement to the data. Available published light element reaction partial widths also compare favorably in those cases where two or more channels are open. Thus extant experimental evidence shows that states of high two-body cluster purity tend to occur near threshold. (auth)

21544 POLARIZATION OF 9·4 Mev PROTONS ELASTICALLY SCATTERED FROM COPPER. A. B. Robbins, K. A. Grotowski, and G. W. Greenlees (Univ. of Birmingham, Eng.). p.419-20 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The polarization of 9.4 Mev protons elastically scattered from copper was measured at 5° intervals from 20 to 150° (c.m.) using a helium polarimeter with counter telescopes. Optical model calculations were made for the polarization distribution, starting with the potential used by Easlea to fit the proton cross section data. By varying the strength of the spin-orbit potential it was possible to obtain a good

fit to the polarization distribution. The real part of the spin orbit potential was found to be (6 ± 1) Mev and the imaginary part less than 1 Mev. (auth)

21545 INELASTIC NEUTRON SCATTERING CROSS SECTIONS IN LEAD ISOTOPES. J. B. Gupta and Narendra Nath (Univ. of Delhi). p.421-2 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Hauser-Feshbach formalism was used to calculate excitation cross sections for the individual levels by inelastic neutron scattering in different lead isotopes. Nuclear penetrabilities based on a diffuse-edge surface potential model were used. The real part of the potential contains a diffused edge while the imaginary part is entirely concentrated in the surface. Comparisons with experimental data show a very poor agreement for the first two or three levels in Pb^{206} at low excitation energies. Good agreements obtained with measurements at higher excitation energies in all the lead isotopes may be fortuitous. Possible reasons for disagreement are pointed out. (auth)

21546 DIRECT INTERACTION PROCESSES. J. B. French (Univ. of Rochester, N. Y.). p.423-36 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Work on direct reaction processes is reviewed. Single-nucleon transfer reactions, two- and three-nucleon transfer reactions, and inelastic scattering are discussed. (M.C.G.)

21547 EXPERIMENTAL EVIDENCE FOR DIRECT INTERACTIONS. H. E. Gove (Atomic Energy of Canada Ltd., Chalk River, Ont.). p.437-61 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The distorted-wave Born approximation for direct interactions is discussed. Calculations using this approximation are summarized. Comparisons were made between distorted-wave calculations and experiments. The Blair inelastic diffraction scattering model which can give detailed information on states possessing collective properties is described. (M.C.G.)

21548 POLARIZATION EFFECTS IN NUCLEAR REACTIONS. L. J. B. Goldfarb (The University, Manchester, Eng.). p.479-94 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The deuteron stripping process and the extent to which polarization studies add to ideas of the direct-reaction mechanism are discussed. Devices for the production and acceleration of polarized protons and deuterons are described. The effects of spin-orbit distortion were investigated. (M.C.G.)

21549 DIRECT INTERACTIONS OF FAST NEUTRONS WITH FLUORINE. E. Kondaiah (Tata Inst. of Fundamental Research, Bombay). p.495-6 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Experimental evidence of direct interactions taking place in the reaction of fast neutrons with fluorine is presented. Evidence for a level at 4 Mev in O^{19}, hitherto not reported, was deduced from range and angular distribution measurements of charged particles emerging from a fluorine target when irradiated with 14 Mev neutrons. Comparison of experimental angular distributions with the surface direct interaction theory of Austern, Butler, and McManus gave the parity of the ground and/or first excited state (at 96 kev) of O^{19} as even and that of 4 Mev level in O^{19} as odd. (auth)

21550 INFORMATION OBTAINABLE FROM REACTIONS AT EXTREME ANGLES. Ian E. McCarthy (Univ. of Adelaide). p.497-8 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Distortion of the incident and emergent waves in direct interactions enables useful information to be obtained from forward and backward reactions. For very small momentum transfers the differential cross section in the distorted wave Born approximation is very small if the reaction involves a parity change, and usually large otherwise. This allows the determination of the relative parity of nuclear states and the identification of 'non-direct' (e.g. compound nucleus) processes at forward angles. Focus effects (e.g. backward peaks) at low energies allow the use of direct interactions to probe the center of the nucleus. (auth)

21551 MECHANISM OF THE REACTION $C^{12}(He^3,n)O^{14}$. G. U. Din, Hsin-min Kuan, and T. W. Bonner (Rice Univ., Houston, Tex.). p.499-500 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Detailed studies were made of the reaction $C^{12}(He^3,n)O^{14}$ for He^3 energies of from 1.8 to 5.3 Mev. The yield curves at 0 and 90° were quite different for He^3 energies in the neighborhood of 2.5 Mev. The total cross section of the reaction was determined by measuring the radioactive O^{14} and a complex resonance centered at 2.5 Mev was observed. Angular distributions were obtained at energies of 1.87, 2.33, 2.66, 2.87, 3.11, 4.02, 4.63, 4.80, and 5.08 Mev. The distributions varied from isotropic at 1.87 Mev to a strongly backward peaking at 2.66 Mev and a forward peaking at energies above 4 Mev. The gross features of the distributions are similar to the double stripping calculations of Gibbs and Tobocman. (auth)

21552 DIRECT INTERACTION EFFECTS IN (n,p)- AND (n,α)-REACTIONS IN CsI. M. Bormann and R. Langkau (Institut für Experimentalphysik, Hamburg). p.501-2 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The (n,p) and (n,α) reactions induced by neutrons produced in deuteron-tritium reactions in CsI were investigated using a pulse shape discrimination method with a CsI(Tl)-scintillation crystal. The energy spectra of the emitted protons and alpha-particles and the cross sections for each reaction were measured for six different neutron energies in the range 12.1 to 21.5 Mev. An analysis of the spectra and cross sections obtained using the statistical theory of nuclear reactions led to the conclusion that beside evaporation processes, direct interaction mechanisms also play an essential part in the reactions investigated. (auth)

21553 DISTORTED-WAVE ANALYSIS OF (d,pγ) REACTIONS. J. R. Rook and P. E. Hodgson (Oxford Univ.). p.503-4 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The distorted-wave theory was used to analyze the reaction $Be^9(d,p\gamma)Be^{10*}$ to the 3.37 Mev state in Be^{10}. Qualitative agreement was obtained between theory and experiment but the large experimental uncertainties prevented an assessment of the significance of the remaining discrepancies. The γ-correlation is not particularly sensitive to the parameters of the distorting potentials so the main purpose of such measurements is to check the validity of the distorted-wave theory. (auth)

21554 DEUTERON ANGULAR DISTRIBUTIONS FROM THE REACTION $V^{51}(n,d)Ti^{50}$ AT 14·4 Mev. K. Ilakovac, L. G. Kuo, M. Petravić, I. Slaus, and P. Tomaš (Inst. "Ruder Bošković," Zagreb). p.505-6 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Deuteron angular distributions were measured for the reaction $V^{51}(n,d)Ti^{50}$ leading to the ground (Q = −5.82 Mev), first (E_{ex} = 1.59 Mev), second (E_{ex} = 2.76 Mev), and third (E_{ex} = 3.27 Mev) excited states of Ti^{50}. The ground state angular distribution agreed reasonably well with a Butler l_p = 3 curve with $r_0 = 6.15 \times 10^{-13}$ cm, and the reduced width obtained was 0.009. Although the excited states were expected to be levels of the ground state configuration $(f_{\frac{7}{2}})^2$, the angular distributions showed no resemblance to that leading to the ground state. This may be due to distortion effects. (auth)

21555 THEORY OF TRANSFER REACTIONS. T. Nishida, G. H. Herling, and G. Breit (Yale Univ., New Haven). p.507-8 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Studies of a schematic model of nucleon transfer reactions indicated that the energy matrix method of calculating the transfer probability caused by tunneling is likely to be more reliable for distinctions between pure tunneling and the participation of virtual Coulomb excitation than for the calculation of absolute values. (auth)

21556 DETERMINATION OF PARITY CHANGE FROM INELASTIC ANGULAR DISTRIBUTIONS. N. M. Hintz, C. D. Kavaloski, L. L. Lee, Jr., and T. Stovall (Univ. of Minnesota, Minneapolis). p.509-10 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Measurements were made of the inelastic angular distributions of 39.7 Mev incident protons to the strongly excited 2+ and 3− states of Ni^{58} and Ni^{60} to study the suggestion of Kromminga and McCarthy that the small angle behavior of direct inelastic cross sections would reveal the parity change. Their suggestion was confirmed. The Blair phase rule was also seen to be moderately well obeyed for protons at 40 Mev. (auth)

21557 STUDIES OF (d,t) REACTIONS ON THE ISOTOPES OF NICKEL. M. H. Macfarlane, B. J. Raz, J. L. Yntema, and B. Zeidman (Argonne National Lab., Ill.). p.511-12 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Angular distributions and absolute cross sections were measured for triton groups resulting from (d,t) reactions on Ni^{58}, Ni^{60}, and Ni^{61} at a deuteron energy of 21.6 Mev. The Butler theory was used, as previously described, to identify l values and extract reduced widths. The reduced widths were then interpreted in terms of the structure of the nuclear states involved. The results of the analysis were that the occupation number for $1f_{\frac{5}{2}}$ neutrons is between 0.3 and 0.6 for Ni^{59}, 0.8 and 1.6 for Ni^{60}, and ≈1 for Ni^{61}. The results for Ni^{59} and Ni^{60} are in good agreement with predictions of the pairing model. (auth)

21558 THE (α,t) REACTION ON NUCLEI. J. L. Yntema (Argonne National Lab., Ill.). p.513-14 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The (α,t) reaction was investigated for a number of nuclei. All transitions observed tend to peak in the forward direction. However, significant differences between l = 1 and l = 3 transitions were observed. The (α,t) reaction proceeded very strongly where the transition involved high l values. The positions of peaks observed in the $Co^{59}(\alpha,t)Ni^{60}$ reaction showed a very strong correlation with states preferentially excited in the inelastic scattering of α particles by Ni^{60}. A similar result was observed for $Cu^{63}(\alpha,t)Zn^{64}$. (auth)

21559 ENERGY DEPENDENCE OF THE $B^{10}(d,p)B^{11}$ ANGULAR DISTRIBUTION. B. Zeidman, J. L. Yntema, and G. R. Satchler (Argonne National Lab., Ill.). p.515-16 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The angular distributions of the $B^{10}(d,p)B^{11}$ ground-state transition were measured at incident energies of 12.5, 15.5, 18.5, and 21.5 Mev. The angular distributions at the higher energies cannot be fitted with Butler's theory for (d,p) reactions. Excellent fits were obtained with distorted-wave theory. There are indications that it is necessary to use an energy-dependent deuteron potential. Non-stripping processes appeared to make very little contribution to this reaction. (auth)

21560 ELASTIC AND INELASTIC SCATTERING OF 43-Mev α PARTICLES IN THE Ni REGION. H. W. Broek, T. H. Braid, J. L. Yntema, and B. Zeidman (Argonne National Lab., Ill.). p.517-18 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Angular distributions for inelastic scattering to the 1.33 (2^+), 4.1 (3^-), and 5.1 Mev (4^+) states of Ni^{60} were fitted to the distorted-wave Born-approximation calculation of Rost and Austern, and distortion parameters were derived. The 2.5 Mev (4^+) state showed an angular distribution which differed widely from the l = 4 curve. Differences in elastic scattering from the various nuclei were noted and ascribed to possible variation of surface thickness. Excitation of the prominent 2^+ groups varied by a factor of 5 with no apparent regularity, while excitation of the 3^- groups tended to increase with increasing A. (auth)

21561 ANGULAR CORRELATIONS IN INELASTIC SCATTERING OF PROTONS FROM Mg^{24}. T. H. Braid, J. L. Yntema, and B. Zeidman (Argonne National Lab., Ill.). p.519-20 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Angular correlation measurements in the reaction $Mg^{24}(p,p'\gamma)Mg^{24}$ at E_p = 10.7 Mev showed strong correlations at θ_p = 30°, 60°, and 90°. Comparison with the predictions of the plane-wave and adiabatic-scattering models indicated a predominant direct-interaction contribution to the scattering at these angles. At θ_p = 120° and 150° there was no agreement with these predictions. (auth)

21562 THE (d,He^3) REACTION NEAR Z = 28. J. L. Yntema, T. H. Braid, B. Zeidman, and H. W. Broek (Argonne National Lab., Ill.). p.521-2 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The (d,He^3) reaction produced by 21.6 Mev deuterons on several targets in the Fe-N region gives information on the proton configurations of the ground states of the target nuclei, and in certain cases on the neutron configurations and excited states. The observed pick-up of p-protons from Ni isotopes indicated excitation of the $f_{\frac{5}{2}}$ proton core. The experiments showed that the neutron configurations of the ground states of Co^{59} and Fe^{58} are probably dissimilar. Admixtures of l = 1 components were observed in the transitions to the first excited states of Ni^{64} and Ni^{62}. This in-

dicated either excitation of the $f_{\frac{5}{2}}$ proton core or an admixture of neutron configurations coupled to spin 2 in the Cu isotopes. (auth)

21563 PICKUP REACTION STUDIES OF NEUTRON BOUND STATES: Fe^{54} AND Co^{59}. C. D. Goodman, J. B. Ball, and C. B. Fulmer (Oak Ridge National Lab., Tenn.). p.523-4 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Deuteron spectra from the pickup reactions $Fe^{54}(p,d)Fe^{53}$ and $Co^{59}(p,d)Co^{58}$ with 22-Mev protons were measured. The angular distributions fit distorted-wave calculations, and reduced widths for certain deuteron groups were extracted by using these calculated cross sections. A reasonable qualitative interpretation of the spectra is given in terms of the j-j coupling shell model with the postulate that the pairing interaction between $f_{\frac{5}{2}}$ neutron and an $f_{\frac{5}{2}}$ proton is about as strong as the pairing interaction between two $f_{\frac{5}{2}}$ neutrons. (auth)

21564 PICKUP REACTION EVIDENCE FOR DEFORMATION OF Fe^{56}, Fe^{57}, AND Fe^{58}. C. D. Goodman, J. B. Ball, and C. B. Fulmer (Oak Ridge National Lab., Tenn.). p.525-6 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Deuteron spectra from the pickup reactions $Fe^{56}(p,d)Fe^{55}$, $Fe^{57}(p,d)Fe^{56}$, and $Fe^{58}(p,d)Fe^{57}$ were measured. Interpretation of the spectra in terms of the j−j coupling shell model without residual interactions failed. The Nilsson model was found useful for the residual interactions; it correctly predicted the level orders in these spectra and accounted for the relationships of these spectra with those from Fe^{54} and Co^{59} targets. This interpretation yielded the result that Fe^{56}, Fe^{57}, and Fe^{58} have prolate deformations. (auth)

21565 EVIDENCE FOR NUCLEAR DISTORTION IN THE IRON REGION. J. B. Ball and C. D. Goodman (Oak Ridge National Lab., Tenn.). p.527-8 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Additional evidence was examined for the postulate that a transition from spherical to distorted nuclear potential occurs in the iron region. The postulate was made for explaining the (p,d) spectra observed in this region. It was concluded that while the ground states of Fe^{54}, Co^{59}, and the nickel isotopes are spherical, it is consistent to assume that the ground states of Cr^{54}, Mn^{55}, Fe^{56}, Fe^{57}, and Fe^{58} are distorted in a prolate configuration. (auth)

21566 ELASTIC SCATTERING OF 13 Mev DEUTERONS ON SOME LIGHT NUCLEI. L. Freindl, H. Niewodniczański, J. Nurzyński, M. Slapa, and A. Strzalkowski (Inst. of Nuclear Physics, Krakow). p.529-30 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Angular distributions for elastic scattering of 13 Mev deuterons on some light nuclei Be, C, Mg, and Ca were measured at 5° angle intervals from 15 to 145° (lab). In order to obtain mass discrimination a counter telescope consisting of two scintillation counters with a thin and a thick scintillator was used. In all cases the measured angular distributions showed a pronounced diffraction-like pattern. A smooth variation of positions of the maxima and minima in differential cross section with mass number can be noticed. The second minimum and the third maximum vanish for elements heavier than Ca, which does not seem to be the optical model feature. Measurements of asymmetries in double elastic scattering of deuterons were also attempted. (auth)

21567 THE $^6Li(t,d)^7Li$ AND $^{10}B(t,d)^{11}B$ REACTIONS. H. D. Holmgren and L. M. Cameron (Naval Research Lab., Washington, D. C.). p.531-2 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The differential cross sections for the ground-state and first excited-state deuteron groups from the $Li^6(t,d)Li^7$ and $B^{10}(t,d)B^{11}$ reactions were studied as functions of the angle of emission and the bombarding energy in the region extending from 0.9 to 2.0 Mev. The cross sections for both reactions increased rapidly with increasing bombarding energy below the coulomb barrier and tended to approach a constant value above this energy. The total cross sections for both reactions are large, 190 and 38 mbn, respectively, at 1.95 Mev, and may indicate that the reactions proceed partly by a cluster exchange type of interaction. (auth)

21568 ANGULAR CORRELATIONS IN THE REACTION $^{10}B(^3He, p\gamma)^{12}C$. E. A. Wolicki, H. D. Holmgren, and R. L. Johnston (Naval Research Lab., Washington, D. C.). p.533-4 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Angular correlations between the 4.43 Mev gamma rays from the first excited state of C^{12} and the corresponding protons were measured for proton angles of 10, 45, 65, 90, and 124 degrees. The incident He^3 energy was 4.50 Mev. The correlations were fitted with the following expression: $W(\theta_\gamma) = 1 + a_2 \cos 2(\theta_\gamma - \theta_2) + a_4 \cos 4(\theta_\gamma - \theta_4)$. For proton angles 10, 45, and 65 degrees the change in θ_2 was in accord with a double stripping mechanism for the reaction. For proton angles 45 through 124 degrees, θ_4 was constant to within a few per cent. (auth)

21569 THE $^{12}C(t, \alpha)^{11}B$ REACTION. H. D. Holmgren, L. M. Cameron, and G. Gutsche (Naval Research Lab., Washington, D. C.). p.535-6 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The differential cross sections for the ground-state and first excited-state groups from the $C^{12}(t,\alpha)B^{11}$ reactions were studied as functions of the angle of emission and the bombarding energy in the region from 1 to 2 Mev. The angular distributions of both groups are complex. The angular distributions of the ground-state group shift slowly toward higher angles with increasing energy, while those for the first excited state shift in the opposite direction. The first excited-state group has a strong resonance at 1.13 Mev which does not affect the shape of the angular distributions. (auth)

21570 THE $^7Li(t, \alpha)^6He$ REACTION. H. D. Holmgren and L. M. Cameron (Naval Research Lab., Washington, D. C.). p.537-8 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The differential cross sections for the ground-state and first two excited-state alpha groups from the $Li^7(t,\alpha)He^6$ reactions were measured as functions of the angle of emission and the bombarding energy in the region from 1 to 2 Mev. All groups exhibited a broad resonance ($\Gamma \simeq 500$ kev) in the region of 1.8 Mev. Forward maxima appeared in the angular distributions of the two highest energy groups at the higher bombarding energies. The backward maxima, which were present at the lowest bombarding energies, were further pronounced at the higher energies. The total cross sections for the ground-state and first excited-state groups at 1.95 Mev are 19 and 25 mbn, respectively. (auth)

21571 THE $^{13}C(^3He, \alpha\gamma)^{12}C$ REACTION. H. D. Holmgren and E. A. Wolicki (Naval Research Lab., Washington, D. C.). p.539-40 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The angular correlations between the first excited-state alpha particles from the $C^{13}(He^3,\alpha)C^{12}$ reaction and the subsequent 4.43-Mev gamma rays were studied as functions of the angle of emission of the gamma rays for alpha particles emitted at laboratory angles of 10, 25, 40, 90, and 128° at a bombarding energy of 4.50 Mev. The correlation functions were fitted with an expression of the form $W(\theta_\gamma) = 1 + b_2 \cos 2(\theta_\gamma - \theta_2) + b_4 \cos 4(\theta_\gamma - \theta_4)$. The cos 4θ term dominated the correlation function at low angles and the θ_4-phase angle remained constant, while the θ_2-phase angle behaved similar to the recoil axis at low angles. (auth)

21572 CLUSTER EFFECTS IN NUCLEAR REACTIONS. H. D. Holmgren and E. A. Wolicki (Naval Research Lab., Washington, D. C.). p.541-2 of the "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Studies of nuclear reactions induced by mass-3 particles disclosed large variations in the values of the absolute cross sections and also striking differences in the energy and angular variations of the differential cross sections from one reaction to another. The mechanism of each nuclear reaction appears to depend intimately upon the structure of the nuclei involved. The cluster expansion of nuclear wave functions appears to be particularly useful for many reactions. Expressions for the cross section in the direct approximation limit are given using this expansion. Some reactions appear to proceed by a cluster-exchange interaction. (auth)

21573 NEUTRONS FROM THE REACTIONS BETWEEN TRITIUM AND HELIUM-3. J. F. Barry, R. Batchelor, and B. E. F. Macefield (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). p.543-4 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The spectrum of neutrons emitted in the reactions between He^3 and tritium, at 3.23 Mev incident energy, was observed with a proton recoil telescope. A high energy group from the reaction $T(He^3,n)Li^5$ (Q-value 10.3 Mev) was resolved from the continuum due to $T(He^3,n\,p)He^4$ reactions. The angular distribution of this neutron group was reasonably consistent with $l = 1$ double stripping to the $P_{\frac{3}{2}}$ state of Li^5. The shape of the continuum suggested that the reaction $T(He^3,p)He^5$, with the subsequent break-up of He^5, is not a major contributor to these neutrons. (auth)

21574 DIRECT NUCLEAR REACTIONS WITH POLARIZED TARGETS. G. R. Satchler (Oak Ridge National Lab., Tenn.). p.545-6 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The advantages and interpretation of nuclear reaction studies with polarized target nuclei are discussed, with particular reference to direct reactions. (auth)

21575 SINGLE-NUCLEON TRANSFER REACTIONS INDUCED BY 28-Mev N^{14} IONS. E. Newman, K. S. Toth, M. L. Halbert, and A. Zucker (Oak Ridge National Lab., Tenn.). p.547-8 of "Proceedings of the Rutherford Jubilee Internation Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The following transfer reactions induced by 28-Mev N^{14} ions were investigated: (1) $N^{14}(N^{14}, N^{13})N^{15}$, (2) $B^{10}(N^{14}, N^{13})B^{11}$, (3) $B^{10}(N^{14}, O^{15})Be^9$, (4) $B^{10}(N^{14}, C^{13})C^{11}$, (5) $B^{11}(N^{14}, C^{13})C^{12}$, and (6) $Mg^{24}(N^{14}, N^{13})Mg^{25}$. For reactions (1) through (4), angular distributions were obtained for the out-going particles that resulted from transfers in which both residual nuclei were left in their ground states. For Rutherford orbits the parameter r_0 was found to be 2.2×10^{-13} cm. Reactions (1) and (2) were also investigated as a function of bombarding energy. It was found that as the incident energy of N^{14} was lowered, the ground-state transfer cross section decreased, while the cross section for transfers to excited states increased. (auth)

21576 INELASTIC SCATTERING OF 31 Mev PROTONS FROM Ni^{60}. H. H. Forster, D. W. Devins, and G. G. Gigas (Univ. of Southern California, Los Angeles). p.549-50 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The differential cross section for the inelastic scattering of 31 Mev protons from the first excited state of Ni^{60} was determined at laboratory angles ranging from 15 to 120° at 2° intervals. The angular distribution of the inelastically scattered protons showed evidence of a diffraction pattern with the maxima out of phase with those obtained for the angular distribution of protons scattered elastically from the same target. (auth)

21577 DOUBLE PICK-UP OF INEQUIVALENT NUCLEONS IN $C^{13}(d,\alpha)B^{11}$. W. P. Alford, O. M. Bilaniuk, and B. B. Marsh (Univ. of Rochester, N. Y.). p.551-2 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Angular distributions of α particles leading to the ground state of B^{11} were observed in the $C^{13}(d,\alpha)B^{11}$ reaction at deuteron energies of 3.26 and 3.45 Mev. These distributions showed a prominent forward peak, suggesting that the reaction proceeds via a double pickup mechanism. It was found that the shapes of the angular distributions are very similar to those observed in cases which can be interpreted as the transfer of a single cluster. Since, in this case, the transferred particles come from different shell-model states, it was seen that the shape of the angular distribution may be insensitive to the internal recoupling of the transferred particles. (auth)

21578 (p,α) REACTION AND SENIORITY IN THE $f_{\frac{7}{2}}$ SHELL. B. F. Bayman, F. P. Brady, and R. Sherr (Princeton Univ., N. J.). p.553-4 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961. (PUC-1961-41)

A study was made of the (18 Mev p,α) reaction on targets of Sc^{45}, Ti^{48}, V^{51}, Mn^{55}, Fe^{56}, Co^{59}, Ni^{58}, and Ni^{60}. The angular distributions were all found to be forward peaked. At a lab angle of 10°, the absolute cross sections for the ground state transition were approximately 40, 550, 35, 18, 800, 18, 1300, and 1600 mb/sterad, respectively. These exhibited a strong odd-even variation. Moreover, whereas the cross section increased with A for even targets, it decreased with A for odd targets. These features may be qualitatively understood on the basis of a pickup mechanism and seniority wave functions. (auth)

21579 FINITE-RANGE DISTORTED-WAVES CALCULATION OF DIRECT REACTIONS. E. C. Halbert (Oak Ridge National Lab., Tenn.), R. M. Drisko, G. R. Satchler, and N. Austern. p.555-6 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Current distorted-wave Born-approximation calculations

of direct nuclear reactions employ a zero-range interaction or an equivalent approximation. An improved distorted wave calculation which correctly treats finite-range interactions or finite-size projectiles was constructed. (auth)

21580 COULOMB-DISTORTED (d,p) ANGULAR DISTRIBUTIONS AS A FUNCTION OF BOMBARDING ENERGY. D. W. Miller (Indiana Univ., Bloomington), H. E. Wegner, and W. S. Hall. p.557-8 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Experimental angular distributions are presented for eight proton groups from the Pb^{206}(d,p) reaction over the range of bombarding energies from 8.3 to 15 Mev. When the best distorted-wave stripping theory fit was obtained to the data of one group at 14 Mev, the correct qualitative features of the angular distributions for the same group at different energies and for different groups at the same energy were generated by the computer without changing the distortion parameters. Comparison of the modest fine structure observed and computed suggested extended use of the stripping reaction for nuclear spectroscopic purposes in heavy nuclei. (auth)

21581 (d,p) POLARIZATION MEASUREMENTS OF EXCITED-STATE REACTIONS. D. W. Miller and W. P. Johnson (Indiana Univ., Bloomington). p.559-60 of "Proceedings of the Rutherford Jubilee International Conference, 1961." New York, Academic Press Inc., 1961.

Huby, Refai, and Satchler made several polarization predictions from distorted-wave stripping theory neglecting spin-orbit coupling in the distorted waves. Two of these predictions were tested using a magnetic spectrometer to separate proton groups before second-scattering in a helium polarimeter. The ratio of the polarizations of the two proton groups corresponding to $p_{\frac{1}{2}}$ and $p_{\frac{3}{2}}$ neutron capture, was predicted to be -0.5; the experimental ratio at one angle for the 1.95 and 3.95 Mev states of Ca^{41} was found to be $-0.07^{+0.18}_{-0.28}$. This discrepancy may indicate the importance of spin-orbit forces in the distorting potentials. (auth)

21582 (p,n) REACTIONS IN MIRROR NUCLEI AND THE NUCLEAR TWO-BODY FORCE. Stewart D. Bloom and Norman K. Glendenning (Univ. of California, Livermore and Berkeley). p.561-2 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Angular distributions and excitation curves from (p,n) reactions in certain mirror nucleus targets were obtained by a variety of techniques, including long counters, time-of-flight discrimination, and activation methods. The basic impetus for this work was the possibility of extracting the proton-neutron interaction in the vicinity of the nuclear medium in a relatively unambiguous way by interpreting the data in terms of direct-reaction theory. Results to date abundantly indicate the correctness of this point of view, both in the manifestly direct character of the data as well as in the two-body force parameters emanating therefrom. (auth)

21583 COMMENTS ON THE INTERPRETATION OF GROSS STRUCTURE STUDIES. W. C. Parkinson (Univ. of Michigan, Ann Arbor). p.563-4 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

High resolution data available for a number of nuclei in the (1d, 2s) shell indicated close lying levels of nearly equal strength, but of opposite parity in the region of 3 Mev excitation. These data are not inconsistent with the rotational model and it is suggested that the difficulty frequently experienced in interpreting gross structure measurements is due to the fact that a large number of nuclei are not spherical. As a result of the deformation the single-particle character of shell model states are spread over a region large compared to the spacing between single-particle levels. (auth)

21584 DEUTERON STRUCTURE EFFECTS IN LOW-Q STRIPPING? D. J. Pullen (Oxford Univ.), D. H. Wilkinson, and A. B. Whitehead. p.565-6 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

All examples of low-Q, low E_d stripping with large cross sections showed good agreement with the simple Butler curves although fits could also be obtained using 'point deuteron' distorted wave analysis. It is suggested that a simpler explanation than a persistent chance cancellation of distortion effects may be that the spatial structure of the deuteron is important in these reactions. Several examples of such reactions are given. (auth)

21585 PHOTO-DISINTEGRATION BELOW THE GIANT RESONANCE. [PARTS] I AND II. Eugene Guth (Oak Ridge National Lab., Tenn.), N. C. Francis, and D. T. Goldman. p.567-70 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The model-independent, Gell-Mann, Goldberger, and Thirring dispersion relation was applied to the photodisintegration of Be^9. The optical-model treatment of the photodisintegration of Be^9 and of C^{13} is related to other experimental and theoretical work. Recent experiments by Jakobson show peaks in the Be^9 (γ,n) cross section at the levels 1.8, 2.43, and 3.2 Mev. Explicit angular distributions and polarizations were obtained for C^{13}. For Be^9 the same calculations are under way. (auth)

21586 INTERACTION OF 14-Mev NEUTRONS WITH NUCLEI. P. Strohal, N. Cindro, and B. Eman (Inst. "Rudjer Bošković," Zagreb). p.571-2 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The results of measurement and theoretical calculations for (n,2n), (n,p), and (n,α) total cross sections for several nuclei around Z = 40 are presented. The experimental results for (n,2n) reactions are in fair agreement with the simple compound nucleus theory, while there is a sharp disagreement between theory and experiment for (n,p) and (n,α) reactions, even after inclusion of shell and pairing corrections into the theory. The effect of the closed N = 50 shell on the reaction mechanism was also investigated. (auth)

21587 DISTORTED WAVE EFFECTS IN STRIPPING. J. B. Garg, N. H. Gale, and J. M. Calvert (The University, Manchester, Eng.). p.573-4 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Measurements were made of the neutron and gamma angular correlations from the B^{11}(d,nγ)C^{12} reaction leading to the 4.43 Mev level in C^{12} at incident deuteron energies of 2.65 and 5.35 Mev and for various directions of the outgoing neutrons. A distorted-wave analysis of the results is discussed. (M.C.G.)

21588 ANGULAR DISTRIBUTIONS OF THE Be^9(d,n)B^{10} NEUTRONS. G. C. Morrison, A. T. G. Ferguson, and J. E. Evans (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.575-6 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

A time-of-flight technique was used to measure the angular distributions of neutrons to the ground state and first three excited states of B^{10} in the reaction $Be^9(d,n)B^{10}$ at incident deuteron energies of 2, 3, and 4 Mev. The measured distributions were very similar in form at each energy studied. At 2 Mev the distributions exhibited approximately equal amounts of forward and backward peaking. As the energy increased a marked increase in the amount of forward peaking with a corresponding shift to smaller angles was observed. The results are discussed on the basis of deuteron stripping theory. (auth)

21589 A STUDY OF THE $C^{12}(d,n)N^{13}$ REACTION. E. W. Fulbright and J. Verba (Univ. of Rochester, N. Y.). p.577-8 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Angular distributions and excitation curves were obtained for the $C^{12}(d,n)N^{13}$ reaction near the 4 Mev resonance. General qualitative agreement with previous work on the $C^{12}(d,p)C^{13}$ reaction was found. However, a program of least squares fitting applied to the data led to different values of the level width and of the resonance energy, and to the speculation that another narrower resonance may also be present. (auth)

21590 CORRELATIONS BETWEEN INCOMING AND OUTGOING POLARIZATION IN DIRECT REACTIONS. L. J. B. Goldfarb and R. C. Johnson (The University, Manchester, Eng.). p.579-80 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

A study was made of the various correlations that can be made between the polarizations of incoming and outgoing beams in direct reactions such as deuteron stripping and the stripping of two nucleons. Attention is given to some of the effects of spin-dependent distortion of the incoming and outgoing waves. (auth)

21591 WAVE DISTORTION IN DIRECT INTERACTIONS. L. R. B. Elton and Daphne F. Jackson (Battersea Coll. of Tech., London). p.581-2 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Inelastic scattering of high energy neutrons by nuclei was investigated in W.K.B. approximation. It was found that the distortion of the scattered wave cannot be represented merely by a change in wave number and that the forward scattering peak in the cross section must be due to refraction rather than diffraction. (auth)

21592 A STUDY OF THE $Mg^{24}(d,p)Mg^{25}$ REACTION. R. Middleton and S. Hinds (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). p.585-6 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The $Mg^{24}(d,p)Mg^{25}$ reaction was studied at an incident energy of 10 Mev using the Aldermaston multi-channel magnetic spectrograph. Angular distributions of the elastically scattered deuterons and 44 proton groups were measured over the range 5° to 175°. None of the angular distributions exhibited backward peaks although 16 have strong forward peaks and these were analyzed with Butler theory. A table of l-value assignments and relative reduced widths is presented. (auth)

21593 A STUDY OF THE $B^{10}(d,p)B^{11}$ REACTION AT A BOMBARDING ENERGY OF 10.1 Mev. S. Hinds and R. Middleton (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). p.587-8 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Angular distributions were measured of some proton groups from the $B^{10}(d,p)B^{11}$ reaction using a multi-channel magnetic spectrograph. Deuterons were accelerated to an energy of 10.1 Mev in the Aldermaston tandem accelerator and measurements were made for the proton groups leading to the ground and first eleven excited states. The distributions displayed a strong variation of intensity, and the stronger ones were fitted with Butler stripping curves. An l = 1 assignment was made to the transition to the 8.927 Mev state of B^{11} which disagrees with a previous assignment of l = 0 + 2 made by Bilaniuk and Hensel. (auth)

21594 ANALYSIS OF THE $l_n = 1$ GROUPS IN THE REACTION $^{35}Cl(d,p)^{36}Cl$. A. M. Hoogenboom (I.K.O., Amsterdam), E. Kashy, and W. W. Buecher. p.589-90 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Experimental $l_n = 1$ angular distributions of 36 proton groups from this reaction were compared with the Butler theory. It is shown that the peak fitting procedure using the nuclear radius as an adjustable parameter does not give satisfactory results. The experimental data indicated that the reaction energy Q should be used as an adjustable parameter, $Q_{(d,p)}$ in the Butler theory. With $Q_{(d,p)} = 6.3$ Mev a reasonable fit can be obtained between theory and experiment for excitation energies in Cl^{36} from 2.5 to 7.0 Mev. (auth)

21595 AN INVESTIGATION OF THE $C^{13}(He^3, n_0)O^{15}$ AND THE $C^{14}(He^3, n_0)O^{16}$ REACTIONS. R. G. Johnson, F. L. Chase, Jr., and F. J. Vaughn (Lockheed Missiles and Space Co., Palo Alto, Calif.). p.591-2 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The $C^{13}(He^3,n_0)O^{15}$ and the $C^{14}(He^3,n_0)O^{16}$ reactions were investigated from about 1.6 to 3.4 Mev using a neutron time-of-flight system. The 10° yield curve for the $C^{13}(He^3,n_0)O^{15}$ reaction increased monotonically with energy. Angular distributions for this reaction obtained at 2.6, 2.8, and 3.1 Mev, were peaked at 0° and exhibited secondary maxima near 100°. The 0°-yield curve for the $C^{14}(He^3,n_0)O^{16}$ reaction exhibited resonance structure at 2.0 and 2.8 Mev. Angular distributions for this reaction were peaked at 0° and at backward angles. The data are compared with the double stripping theory of Newns. (auth)

21596 DISTORTED-WAVE CALCULATIONS OF THE $Li^7(d,p)Li^8$ STRIPPING REACTION. J. H. Halton and P. E. Hodgson (Oxford Univ.). p.593-4 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Experimental differential cross sections for the reaction $Li^7(d,p)Li^8$ (G.S.) were analyzed by the Butler and distorted-wave stripping theories to yield estimates of the reduced widths. The distorted-wave theory produced a better fit to the experimental results and a more nearly constant θ^2 for the range 2 to 4 Mev of incident deuteron energy. These values were about ten times greater than those obtained from the Butler theory. (auth)

21597 MEASUREMENTS OF PROTON POLARIZATION IN DEUTERON STRIPPING AT 15 Mev. A. Isoya, S. Micheletti, M. J. Marrone, and L. H. Reber (Univ. of Pittsburgh). p.595-6 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The angular dependence of the proton polarization was

measured for a number of (d,p) stripping reactions initiated by 15 Mev deuterons. Transitions corresponding to an angular momentum transfer equal to zero were studied on Al^{27} and Si^{28} and corresponding to an angular momentum transfer equal to one on C^{12}, Mg^{24}, and V^{51}. (auth)

21598 STUDIES ON THE $Li^6(Li^6, d)B^{10}$ AND $Li^7(Li^6, t)B^{10}$ REACTIONS WITH 6 Mev LITHIUM IONS. D. A. Bromley, K. Nagatani, L. C. Northcliffe, R. Ollerhead, and A. R. Quinton (Yale Univ., New Haven). p.597-8 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The reactions $Li^6(Li^6,d)B^{10}$ and $Li^7(Li^6,t)B^{10}$ were examined using the 6 Mev/nucleon lithium beam from the Yale Heavy Ion Linear Accelerator and a $(dE/dx) \times E$ particle identification system. Deuteron and triton groups to the ground and first three excited states of B^{10} were detected; as found by Morrison, using 2 Mev lithium ions, both reactions leading to the 1.74 Mev 0+, T = 1 state in B^{10} were strongly inhibited providing strong support for a direct interaction mechanism. (auth)

21599 ON THE EFFECT OF PROTON SPIN-ORBIT DISTORTION IN A (d,p) REACTION. R. C. Johnson (The University, Manchester, Eng.). p.599-600 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The angular distribution and polarization of the protons in the reaction $C^{12}(d,p)C^{13*}$ (first excited state) were calculated for a deuteron energy of 6 Mev (C.M.) taking into account spin-dependent distortion of the proton. The proton polarization, which vanishes if spin-dependent distortion is neglected, was found to be large, but the angular distribution was insensitive to the inclusion of such effects. (auth)

21600 FIRST ORDER EFFECTS OF SPIN-DEPENDENT DISTORTION IN DIRECT REACTIONS. R. C. Johnson (The University, Manchester, Eng.). p.601-2 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

A first order treatment of proton spin-orbit distortion in an an $l(n) = 0$ deuteron stripping reaction is given. To this approximation, the angular distribution was independent of the spin-orbit potential and the proton polarization was found to agree closely with exact calculations in a special case. Simple expressions for the polarization were found, which may be useful for the study of polarization effects in deuteron stripping. (auth)

21601 EVIDENCE FOR DIRECT INTERACTION IN α-INDUCED REACTIONS AT LOW ENERGIES. J. B. Garg and N. H. Gale (The University, Manchester, Eng.). p.603-4 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Several (n,γ) angular correlations from the reaction $Be^9(\alpha,n)C^{12}$ leading to the 4.43 Mev level in C^{12} were measured using a time-of-flight technique. The measurements were made at an incident α-particle energy of 5.35 Mev, and for various positions of the neutron counter. The results of these measurements showed qualitative agreement with the expectation of plane wave theories of the direct interactions. (auth)

21602 ANGULAR DISTRIBUTIONS OF NEUTRONS FROM THE REACTION $Li^7(\alpha,n)B^{10}$ AT 13.5 AND 13.9 Mev. J. Kjellman, A. Nilsson, and S. Schwarz (Inst. of National Defence and Nobel Inst., Stockholm). p.605-6 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Neutron angular distributions from the reaction $Li^7(\alpha,n)B^{10}$ at 13.5 and 13.9 Mev were studied by time-of-flight with α particles from the 80 cm cyclotron at the Nobel Institute. Five neutron groups were observed corresponding to the ground state and the four lowest excited states in B^{10}. The higher α-energy gave an excitation of the compound nucleus B^{11} coinciding with a resonance in the excitation function. A method for splitting up the unresolved double-peak due to n_0 and n_1 in the forward directions was developed. The angular distributions of the groups n_0 and n_1 are presented. (auth)

21603 THE REACTION $C^{12}(C^{12},\alpha)Ne^{20}$. A. J. P. L. Policarpo, W. R. Phillips, and J. C. Lisle (Univ. of Manchester, Eng.). p.607-8 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Differential cross sections for the reaction $C^{12}(C^{12},\alpha)Ne^{20}$ leading to the first two levels in Ne^{20} were measured at a bombarding energy of 12.5 Mev. The total cross sections are 2.2 ± 0.4 mb and 7 ± 1.4 mb to the ground and first excited states, respectively. The ground state group's angular distribution showed features which can be reproduced by considering the reaction to proceed via a stripping mechanism. (auth)

21604 NOTE ON THE TWO NUCLEON STRIPPING REACTION. S. Yoshida (Univ. of Pittsburgh). p.609-10 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The magnitude of the two nucleon stripping reaction was calculated using the pairing interaction model, and it is applied to the collective state. For some types of reaction the collective enhancement of the reaction cross section is predicted. (auth)

21605 LIMITATIONS AND NEEDS IN INSTRUMENTATION FOR NUCLEAR PHYSICS. Samuel Devons (Columbia Univ., New York). p.611-39 of "Proceedings of the Rutherford Jubilee International Conference, 1961." New York, Academic Press Inc., 1961.

Developments in technique and instrumentation in nuclear physics are discussed. Examples are given which illustrate some limitations of current technique and some future possibilities. Techniques and instruments for studying the following properties of nuclear structure are discussed: electromagnetic properties, ground-state properties, electromagnetic transitions, beta decay, and nuclear collisions. (M.C.G.)

21606 RUTHERFORD AND NUCLEAR COSMOCHRONOLOGY. William Alfred Fowler (California Inst. of Tech., Pasadena). p.640-76 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Rutherford's studies of the age of the earth and its rocks and of the sun are reviewed. Determinations of the half lives of nuclear chronometers are described. Attempts to make quantitative use of the radioactive decays of uranium and thorium in cosmochronology are discussed. Specific and current treatments of the ages of astronomical systems are described. The ages of the universe, galaxy, solar system, and elements and methods of determining these ages are discussed. (M.C.G.)

21607 MESONIC AND OTHER CORRECTIONS IN β-DECAY. R. J. Blin-Stoyle (Oxford Univ.). p.677-88 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Small effects in beta decay are discussed. Topics covered include: corrections to pure Fermi transitions, the conserved vector current hypothesis, value of G_A^2/G_V^2 (polar and axial vector coupling constants), and considerations of other simple nuclei. Discrepancies in the correlations of Gamow-Teller matrix elements in the beta decay of mirror nuclei with the magnetic moments of these nuclei are outlined. (M.C.G.)

21608 SYSTEMATICS OF BETA-DECAY MATRIX ELEMENTS. Steven A. Moszkowski (Univ. of California, Los Angeles). p.689-95 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Recent developments in beta decay which shed some light on nuclear matrix elements are outlined. Studies of the beta decay of strongly deformed nuclei, isotopic spin conservation, and first forbidden non-unique decays are discussed. Characteristics of the beta decays of Ce^{141} and Bi^{210} are described. (M.C.G.)

21609 MUON CAPTURE IN NUCLEI. C. Rubbia (CERN, Geneva). p.707-14 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The fundamental process responsible for meson (μ) absorption by nuclei was believed to be $\mu^- + p \rightarrow n + \nu$. Data from various sources were searched for experimental evidence of this reaction. A comparison is presented of beta decay and meson (μ) capture. The neutrinoless conversion of a meson (μ) into an electron is discussed. (M.C.G.)

21610 ON THE SPIN-DEPENDENCE OF THE INTERACTION RESPONSIBLE FOR MUON CAPTURE. V. L. Telegdi (Univ. of Chicago). p.715-17 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The spin-dependence of meson (μ) capture is discussed. Methods of measuring this spin-dependence are described. (M.C.G.)

21611 THE DECAY OF BOUND MUONS. L. Krueger and J. Rothleitner (Universität, Heidelberg). p.721-2 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The decay rate of bound muons from the K-shell and the spectrum of the decay electrons were calculated for seven elements up to lead. The muon was represented by a non-relativistic wave function in the potential of a realistic nuclear charge distribution. The electron wave function was expanded in partial waves which allows taking into account exactly the relativistic and the finite nuclear size effects. The decay rate decreased monotonically but slowly with increasing atomic number. This agreed with earlier theoretical predictions but contradicted most of the experimental results for medium as well as high atomic number. (auth)

21612 THE BETA-DECAY OF RaE. Jun-Ichi Fujita (Indiana Univ., Bloomington). p.723-4 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The spectrum of Bi^{210} beta-decay was previously explained as an accidental cancellation between nuclear matrix elements. However, it is known that the nuclear matrix elements found empirically are not in agreement with the theoretical values predicted by a simple shell model picture. The Bi^{210} decay was re-investigated using data on electron longitudinal polarization. This re-analysis led to an even larger disagreement between the shell prediction and the experimentally determined nuclear matrix elements. The possible origins of this disagreement are discussed from several viewpoints, and a new type of collective motion is briefly discussed. This type of collective motion is important only for the beta-decay matrix element, fr. (auth)

21613 RELATIVISTIC MATRIX ELEMENTS AND THE VELOCITY DEPENDENCE OF NUCLEAR POTENTIALS. R. W. Hayward and D. D. Hoppes (National Bureau of Standards, Washington, D. C.). p.725-8 of "Proceedings of the Rutherford Jubilee International Conference, 1961." New York, Academic Press Inc., 1961.

The forbidden beta-decay matrix elements were measured in the transitions of Ce^{141} to the ground and first excited states of Pr^{141}. The relative values of the momentum dependent matrix elements, when analyzed on the basis of an independent particle model, provided information on the nuclear potential. The parameters of a velocity dependent, isotopic spin independent, potential with spin-orbit splitting were determined. (auth)

21614 RELATIVE MEASUREMENTS ON THE LONGITUDINAL POLARIZATION OF BETA RAYS FROM Na^{24}, Mn^{56}, Sb^{122}, Ho^{166}, AND Au^{198}. R. Sosnowski, Z. Wilhelmi, and J. Wojtkowska (Inst. for Nuclear Research, Polish Academy of Sciences and Univ. of Warsaw). p.729-30 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961. (PAN-220/I-A)

The longitudinal polarization of electrons from β decay of Na^{24}, Mn^{56}, Sb^{122}, Ho^{166}, and Au^{198} were compared. The degree of polarization was measured by the electron scattering in a thin gold foil. Longitudinal polarization was changed into a transverse one by means of crossed electric and magnetic fields. The measurements were carried out for the electrons with $v/c = 0.85$. The results suggested that the longitudinal polarization is not identical for the measured beta transitions. (auth)

21615 MEASUREMENTS OF (p,n) REACTION Q-VALUES OF INTEREST IN β-DECAY THEORY. J. M. Freeman and D. West (Atomic Energy Research Establishment, Harwell, Berks, Eng.). p.731-2 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

A new measurement of the $Mg^{26}(p,n)Al^{26*}$ Q-value is reported. The value obtained is -5.017 ± 0.007 Mev corresponding to an end point energy for the β^+ from Al^{26*} (0^+, T = 1) of 3.212 ± 0.007 Mev. (auth)

21616 ISOSPIN CONSERVATION AND β-γ CIRCULAR-POLARIZATION CORRELATION. Stewart D. Bloom and Lloyd G. Mann (Univ. of California, Livermore). p.733-4 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The β-γ circular-polarization angular correlation was measured in six mixed transitions: Na^{24}, Ar^{41}, Sc^{44}, Sc^{46}, Mn^{52}, and Cs^{134}. Measurements were made using the method of rapid alternation plus calibration interlacing runs on Na^{22} and Co^{60} sources, regarded as known standards in the (A-V) theory. In the first five of these cases the findings indicated a Fermi matrix-element which is very small or vanishing. The case of Cs^{134} constituted the only definite evidence found so far for a non-zero interference effect, but the large log (ft) value of 8.8 again suggested a very small (though non-zero) Fermi matrix-element. (auth)

21617 S MATRIX DESCRIPTION OF DECAYS. J. Werle (Inst. for Nuclear Research, Warsaw). p.735-6 of

"Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The problem of applying the S matrix formalism to decays was investigated. It is shown that the difficulties present in the usual treatment of decays can be removed by introduction of the mass spread and additional integration over the mass of the unstable particle in the decay term of the S matrix. However the S matrix obtained in this way does not fix the actual mass distribution of the unstable particle which can depend on the production conditions. All observed quantities can be made practically independent of the actual mass distribution. (auth)

21618 THE $\Delta T = 0$ ISOTOPIC SELECTION RULE IN FERMI TRANSITIONS AND THE THEORY OF THE VECTOR INTERACTION IN BETA DECAY. Claude C. Bouchiat (Faculté des Sciences, Orsay, France). p.737-8 of "Proceedings of the Rutherford Jubilee International Conference, 1961." New York, Academic Press Inc., 1961.

In theory of the vector interaction with a conserved current the observed deviations from the $\Delta T = 0$ selection rule in Fermi transitions have to be explained only in terms of isotopic spin impurities. However in the conventional theory exchange mesonic currents may also induce Fermi transitions with $\Delta T \neq 0$. It is shown that these two contributions behave differently under the operation of charge symmetry. By comparing two image transitions it is then possible to formulate a necessary condition for the validity of the theory with a conserved current independently of any nuclear model. As an example the beta decay of the Na^{24}–Al^{24} nuclei is discussed. An analysis was made of the experimental data using shell model wave functions to estimate the isotopic spin admixtures. (auth)

21619 VELOCITY-DEPENDENT NUCLEAR FORCES. R. E. Peierls (The University, Birmingham, Eng.). p.739-48 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The problem of velocity-dependent nuclear forces was considered beginning at a central potential whose dependence is at most quadratic. (M.C.G.)

21620 THE THREE-PION RESONANCE AND ITS IMPLICATIONS. H. Pierre Noyes (Univ. of California, Livermore). p.749-58 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Evidence for a 3-π, $J = 1^-$ resonance at 785 Mev was obtained for the examination of 2500 4-prong antiproton annihilation events in the 72-in. hydrogen bubble chamber. Of these, 800 were attributed to the process $\bar{p} + p \rightarrow \pi^+ + \pi^- + \pi^+ + \pi^- + \pi^0$. An attempt to assign the spin and parity of the resonance was made by comparing a Dalitz plot at the peak with a similar number of events in a region well removed from the peak. Preliminary evidence for the assignment 1^- was obtained. The way in which this resonance fits into the current picture of the nucleon electromagnetic structure and the nucleon-nucleon, meson(π)-nucleon, and meson(π)-meson(π) interactions is discussed. The importance of the 3π resonance is assessed. (M.C.G.)

21621 NUCLEAR MODELS—SELECTED TOPICS CONCERNING NUCLEAR SPECTRA. A. Bohr (Universitet, Copenhagen). p.759-62 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Progress made in exploration of the details of nuclear spectra is reviewed. Characteristics of the spectra of deformed nuclei are described. Methods of quantitatively testing the interpretation of the spectrum are discussed. The calculation of vibrational states and quasi-particle spectra are also discussed. (M.C.G.)

21622 THE SHELL-MODEL AND ITS RELATION TO ROTATIONS AND VIBRATIONS. S. Meshkov (Weizmann Inst. of Science, Rehovoth, Israel). p.763-8 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Introduction of the phenomenological assumption of a rotator into shell model calculations is discussed. In order to allow the Hamiltonian to determine a self-consistent deformation and even to allow for a varying deformation, a method was developed including these effects along with those of rotations in the framework of the shell model. (M.C.G.)

21623 THE INDISTINGUISHABILITY OF NUCLEONS AND NUCLEAR REACTIONS. K. Wildermuth (Florida State Univ., [Tallahassee]), E. Schmid, and R. Carovillano, p.769-70 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Some special examples are discussed which show the influence of the indistinguishability of the nucleons on nuclear reactions. For instance it is pointed out why optical Giant resonances can also appear in the scattering of composite particles on nuclei. Furthermore, a comparison between the measured and calculated phase shifts in the α-α scattering is presented. (auth)

21624 RELATION BETWEEN THE OPTICAL MODEL AND RESONANCE THEORY. P. A. Moldauer (Argonne National Lab., Ill.). p.771-2 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The resonance contribution to the average diagonal scattering matrix $\langle U_{cc} \rangle = \exp(2i\delta_c)$, where δ_c is the optical model phase shift, can be written in the simple form applicable for slow neutron scattering $[1 - \pi\langle\Gamma_{\lambda c}\rangle/D_c]$ $\exp(-2i\varphi_c)$ so long as the average total resonance width does not exceed the average level spacing for the compound nucleus level sequence involved. The $2\pi\langle\Gamma_{\lambda c}\rangle/D_c$ are the resonance parameters appearing as transmission coefficients in the Hauser-Feshbach reaction cross section formula. (auth)

21625 ANGULAR MOMENTUM EFFECTS IN NUCLEAR EVAPORATION. M. L. Halbert and C. E. Hunting (Oak Ridge National Lab., Tenn.). p.773-4 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Angular distributions were measured for protons from reactions of N^{14} (at 21.4 and 27.4 Mev) on F^{19} and for alphas from N^{14} (at 27.2 Mev) on O^{16}. Forward and backward peaking was observed, with approximate symmetry about 90° (cm). From the proton data, the parameter σ, appearing in the expression $(2j + 1)\exp - [j(j + 1)/2\sigma^2]$ for the spin dependence of the level density, is about 3 for P^{32}. This implies a moment of inertia approximately equal to the rigid-body value. The alphas were more anisotropic, and the simplified analysis applied to the protons was inadequate. Least-squares fits were obtained by use of Legendre polynomials. (auth)

21626 EXCITATION FUNCTIONS OF $V^{51}(p,n\gamma)Cr^{51}$ REACTIONS. Y. Cassagnou, J. M. F. Jeronymo, C. Levi, L. Papineau, and D. Stanojevic (Centre d'Etudes Nucléaires, Saclay, France). p.775-6 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Levels up to 3 Mev excitation in Cr^{51} and a preliminary disintegration scheme are given. The excitation functions of gamma rays show resonant structure. The mean level spacing of Cr^{52} at 14.8 Mev excitation was found to range about 1 kev. The total cross section for $V^{51}(p,n)Cr^{51}$ reaction at 4.26 Mev proton energy was found to be 220 ± 30 mb. (auth)

21627 SOME ENERGY LEVEL DETERMINATIONS OF O^{18}, O^{20}, F^{21}, AND Na^{25}. S. Hinds and R. Middleton (Atomic Weapons Research Establishment, Aldermaston, Berks, Eng.). p.777-8 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Some energy level determinations of O^{18}, O^{20}, F^{21}, and Na^{25} were made using the Aldermaston 6 Mev electrostatic generator and broad-range magnetic spectrograph. The reactions studied and number of levels observed were as follows: O^{18} from $O^{16}(t,p)O^{18}$ gave 13 levels below 6.391 Mev, O^{18} from $F^{19}(t,\alpha)O^{18}$ gave 26 levels below 8.64 Mev, O^{20} from $O^{18}(t,p)O^{20}$ gave 11 levels below 5.83 Mev, F^{21} from $F^{19}(t,p)F^{21}$ gave 19 levels below 5.064 Mev, and Na^{25} from $Na^{23}(t,p)Na^{25}$ and $Mg^{26}(t,\alpha)Na^{25}$ gave 29 levels below 5.746 Mev. (auth)

21628 STOPPING POWER OF GASEOUS HYDROGEN FOR CHARGE-INVARIANT ATOMIC PROJECTILES. Samuel K. Allison, J. Cuevas, and M. Garcia-Munoz (Univ. of Chicago). p.779-80 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The stopping power of hydrogen gas for the pure neutral state of hydrogen, helium, and neon projectiles was measured by putting the stopping cell in a strong transverse magnetic field, selecting in this way those fast neutral particles which do not change their charge in the stopping process. These measurements gave values considerably smaller than the total stopping power. (auth)

21629 THE ELASTIC SCATTERING OF DEUTERONS BY CARBON. Silva D. Ćirilov (Inst. of Nuclear Sciences, Boris Kidrich, Belgrade). p.781-2 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The elastic scattering of deuterons by carbon was measured in the energy range 1 to 1.46 Mev at the scattering angles of 90, 140, 150, 160, and 170 degrees in the laboratory system, with the photographic emulsion method. The ratio of the observed to the Rutherford scattering was plotted as a function of incident energy. Anomalous scattering was observed near deuteron bombarding energies of 1.05, 1.12, 1.20, 1.30, and 1.44 Mev. (auth)

21630 RECENT PRECISION DETERMINATIONS OF RESONANCE, THRESHOLD AND NATURAL α-PARTICLE ENERGIES. A. Rytz, H. Staub, H. Winkler, and W. Zych (Universität, Zurich). p.783-4 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Measurements were made of the energies of the resonance of $Al(p,\gamma)Si^{28}$ and threshold of $H^3(p,n)He^3$. A magnetic spectrometer was used. (M.C.G.)

21631 THE STRUCTURE OF MASS 18 NUCLEI. D. Wilmore (The University, Manchester, Eng.). p.785-6 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

A shell model calculation of the levels of the mass 18 nuclei was performed using an over-all potential of Woods-Saxon form. The results were compared with those obtained by using the harmonic oscillator potential, and it is shown that satisfactory agreement with the experimentally observed levels in O^{18}, and the first three T = 0 states observed in F^{18}, can be obtained. (auth)

21632 A 2— ASSIGNMENT FOR THE 4.97 Mev LEVEL IN Ne^{20}. H. E. Gove, A. E. Litherland, and M. A. Clark (Atomic Energy of Canada Ltd., Chalk River, Ont.). p.787-90 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The $Ne^{20}(p,p'\gamma)Ne^{20}$ reaction was used to measure the linear polarization of 3.34 Mev gamma rays by Compton scattering, and this measurement combined, with the angular distribution of the gamma ray, defined its electric character and thereby demonstrated that the levels concerned at 4.97 and 1.63 Mev have opposite parity. The 1.63 Mev level has positive parity and the 4.97 Mev level has J = 2. This 2− assignment for the 4.97 Mev level excludes it from helium thermonuclear reactions in stars. (auth)

21633 DE-EXCITATION BRANCHING AND RADIATIVE WIDTHS OF 5.63 AND 5.80 Mev LEVELS OF Ne^{20}. J. A. Kuehner and E. Almqvist (Atomic Energy of Canada Ltd., Chalk River, Ont.). p.793-4 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Values of $\Gamma\gamma/\Gamma$ were determined for the 5.63 and 5.80 Mev levels of Ne^{20} and are 0.07 (±0.01) and 0.003 (±0.003), respectively. Assuming an upper limit of 10% of the calculated single particle widths for alpha particle emission, limits on the quantity $\Gamma\gamma$ are set at $<2 \times 10^{-4}$ ev and $<5 \times 10^{-3}$ ev, respectively. The ratio of these derived gamma widths to the Weisskopf estimate for E1 transitions are $<4 \times 10^{-6}$ and $<3 \times 10^{-5}$, respectively. Thus, each of these levels exhibits either highly inhibited gamma de-excitation widths or much enhanced alpha particle widths. (auth)

21634 HEAVY ION INDUCED FRAGMENTATION STUDIES. D. A. Bromley, M. Sachs, and C. E. Anderson (Yale Univ., New Haven). p.815-16 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Studies on heavy nuclear fragments associated with high energy heavy ion induced reactions demonstrated that the total cross section for heavy fragment production is roughly one-third of the geometric cross section, and that, with the exception of single nucleon transfer products, the radioactive fragments comprise roughly 5% of the total yield. From the measured fragment angular distribution it was concluded that the dominant mechanism is one wherein the projectile is fragmented in the collision, although a significant residual yield from more complex processes remains. Structure was observed in some of the fragment energy spectra. (auth)

21635 GAMMA-GAMMA DIRECTIONAL CORRELATIONS IN Pb^{208}. L. Simons, M. Brenner, L. Kaeld, K.-E. Nystén, and E. Spring (Univ. of Helsinki). p.817-18 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

By measuring angular correlations of the gamma rays 583 to 2615, 511 to 583, 511 to 2615, 860 to 2615, and 763 to 2615 kev the commonly accepted level scheme of Pb^{208} was verified for the energy levels covered in the measurements. The mixed radiations were all M1 + E2 mixtures. For the 511 kev gamma ray $\delta = -0.06 \pm 0.05$ was found and for the 860 kev $\delta = -0.023 \pm 0.10$. There is uncertainty about the spin of the 3961 kev level, the most probable assignment being 6^-. Perfect agreement was found between

the experimental and the theoretical functions of the angular correlation 763 to 2615 kev, if the 763 kev gamma radiation is a M1 + E2 mixture with $\delta = -0.45 \pm 0.15$. (auth)

21636 ONE-MINUTE POSITRON-DECAY ACTIVITY FROM $K^{39}(\alpha,n)Sc^{42}$. J. W. Nelson, H. S. Plendl, and J. D. Oberholtzer (Florida State Univ., Tallahassee). p.819-20 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

A 62-sec, 0.51-Mev gamma activity observed in the alpha bombardment of potassium targets was ascribed to the β^+ decay of an isomeric state in Sc^{42} formed by the $K^{39}(\alpha,n)$ reaction. Gamma rays observed in coincidence with the above activity and of the same half life were interpreted as transitions from the Ca^{42} excited state formed in the β^+ decay to the Ca^{42} ground state. The threshold for this activity occurs at $E_\alpha = 8.86 \pm 0.04$ Mev ($Q = -8.04 \pm 0.04$ Mev). (auth)

21637 EVIDENCE FOR THREE ALPHA PARTICLE BREAK-UP OF C^{12*} (16.11 Mev). D. Dehnhard, D. Kamke, and P. Kramer (Universität, Marburg/Lahn, Ger.). p.821-2 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Above and below the 163 kev resonance, the $C^{12*} \rightarrow \alpha_1 + Be^{8*} \rightarrow \alpha_1 + \alpha_{11} + \alpha_{12}$ cascading decay mode was confirmed, while within the resonance a simultaneous break-up of C^{12*} into 3 α particles was suggested. (M.C.G.)

21638 RADIATIVE CAPTURE OF DEUTERONS IN Be^9 AND C^{12}. H.-H. Knitter and H. Waeffler (Max-Planck-Institut für Chemie, Mainz). p.823-4 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

Deuteron capture in Be^9 and C^{12} was observed using praseodymium and copper as (γ,n)-threshold detectors. Cross sections of 6.5 and 0.3 μb were found for 1.3 and 1 Mev deuterons, respectively. (auth)

21639 THEORETICAL INVESTIGATION OF SLIT SCATTERING. E. J. Burge and D. A. Smith (King's Coll., London). p.825-6 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

An expression was obtained for the effective increase in size of an aperture produced by slit scattering. The derivation took into account the continuous energy loss of the diffusing beam of protons in the material. Computations for 25 elements for 50 Mev incident protons, and a preliminary analysis of the origin of the slit scattered protons, suggested that a carbon collimator (for low neutron production) whould be lined with a thin sleeve of Cu or Ni to reduce slit edge effects. (auth)

21640 INELASTIC ELECTRON SCATTERING FROM THE DEUTERON. G. A. Peterson and W. C. Barber (Stanford Univ., Calif.). p.831-2 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The magnetic dipole disintegration of the deuteron was studied by the inelastic scattering of 41.4 Mev electrons from C, CD_2, and CH_2 targets at 132, 160, and 180°. The measurements at 180° were made by using a new technique which minimizes the background radiative tail arising from elastic scattering. The magnitude of the deuteron inelastic cross section was obtained by finding the ratio of the inelastic scattering from the deuteron to the elastic scattering from the proton. Near threshold the results are in agreement with the theory of Jankus, but at high excitation energies a discrepancy was observed. (auth)

21641 INELASTIC NUCLEAR SCATTERING OF PHOTONS. O. V. Bogdankevich, B. S. Dolbilkin, L. E. Lazareva, A. M. Moiseev, and F. A. Nikolaev (Lebedev Inst. of Physics, Moscow). p.833-5 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961.

The cross sections for inelastic nuclear scattering of protons by Y^{89}, Rh^{103}, Ag^{107}, In^{115}, and Au^{197} are discussed. An estimate of the relative radiative width was obtained from these data. (auth)

Particle Accelerators

21642 (AD-267612) A SIMPLE METHOD FOR IMPROVING THE RESOLUTION OF A VAN DE GRAAFF ACCELERATOR (thesis). Richard Edward Smith (Air Force Inst. of Tech., Wright-Patterson AFB, Ohio). Aug. 1961. 49p. (GA/Phys/61-6).

A simple method for improving the energy resolution of the ion beam of a Van de Graaff accelerator is described. The voltage variations of the high-potential terminal are sensed by a probe through capacitive coupling. This signal is then amplified to correspond to the variation of the terminal and applied to the target so that the effect of the voltage variation is canceled. The effective energy of the Van de Graaff is changed in small increments by biasing the target with a stepping-voltage power supply. (auth)

21643 (AERE-Memo-G/M-37) CORRECTED DIMENSIONS FOR 10 Mev. M.R.C. LINEAR ACCELERATOR. Marjory Bruce and W. Walkinshaw (Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England). Oct. 26, 1949. 5p.

Corrected dimensions for the 2-cm pitch section of the accelerator are presented based on the Metropolitan-Vickers measurements. Results give some indication of the tolerances of guide radius and iris-hole radius. (M.C.G.)

21644 (CERN-62-4) THE DESIGN OF INJECTION SYSTEMS WITH APPLICATION TO THE CERN STORAGE RING MODEL. P. T. Kirstein (European Organization for Nuclear Research, Geneva). Jan. 24, 1962. 51p.

Techniques useful in the design of beam transport system are considered. Those applicable to the design of the injection system for the 2 Mev Storage Ring Model being constructed at CERN are treated in some detail. In particular, formulas are quoted or derived for the design of the achromatic system, the placing of apertures, the analysis of symmetric triplets, and the matching of the acceptance of one part of a beam transport system to the emittance of another. The techniques previously described are then illustrated in the design of an injection system for the CERN Storage Ring Model. (auth)

21645 (CERN-62-19) LOW ENERGY PARTICLES FROM THE CERN PS. W. A. Cooper, H. Courant, H. Filthuth, A. M. Segar, G. Snow, and W. Willis (European Organization for Nuclear Research, Geneva). May 17, 1962. 10p.

The production of low energy particles by 19.2 Bev/c protons from an internal beryllium target in the CERN proton synchrotron was studied. The K1-beam in the North experimental hall was used to separate the different kinds of particles (π^+, K^+, p, $\bar{p}$) from each other. The target emission angle varied according to the beam momentum and charge. The results are graphically and tabularly presented. The steep rise of the K fluxes and the K/π ratios with increasing momentum is very remarkable. (N.W.R.)

21646 (LAL-1010) LABORATOIRE DE L'ACCELERATEUR LINEAIRE RAPPORT D'ACTIVITE (AVRIL 1,

1960–OCTOBRE 1, 1960). (Linear Accelerator Laboratory Report of Activities for April 1960–October 1960). D. Frerejacque (Paris. Université, Orsay. École Normale Supérieure. Laboratoire de l'Accélerateur Linéaire). Nov. 15, 1960. 49p.

Topics covered are the performance of the accelerator, experimental high-energy and low-energy physics, the work of the technology and electronic groups, hyperfrequency studies, magnet studies, and radiation measurement. A brief indication is given of the experiments being carried on in these areas. (J.S.R.)

21647 (LAL-1021) LABORATOIRE DE L'ACCELERATEUR LINEAIRE RAPPORT D'ACTIVITE (AVRIL 15, 1960–OCTOBRE 15, 1961). (Linear Accelerator Laboratory Report of Activities for April–October 1961). D. Frerejacque (Paris. Université, Orsay. École Normale Supérieure. Laboratoire de l'Accélerateur Linéaire). Oct. 15, 1961. 54p.

Topics covered are the performance of the linear accelerator, experimental high-energy and low-energy physics, the work of the technology and electronic group, hyperfrequency studies, magnet studies, radiation measurements, and radiochemical studies. The studies being made in each of these areas are briefly indicated. (J.S.R.)

21648 (MURA-634) PERTURBATION THEORY FOR ACCELERATORS WITH A GENERAL MAGNETIC FIELD. G. Parzen (Midwestern Universities Research Assn., Madison, Wis.). Jan. 3, 1962. Contract AT(11-1)-384. 14p.

The problem of calculating the effect of field perturbation on the linear orbit properties of an accelerator with a general magnetic field is treated. The perturbing magnetic field in the median plane is assumed to have only a vertical component and to have the same periodicity as the unperturbed field. Results are found for the change in the equilibrium orbit, and in the betatron oscillation frequencies caused by the perturbation. (auth)

21649 (NIRL/R/12) DESIGN STUDIES FOR THE NIMROD EXTERNAL PROTON BEAM. J. W. Gardner, N. M. King, and D. Whiteside (Gt. Brit. National Inst. for Research in Nuclear Science. Rutherford High Energy Lab., Harwell, Berks, England). 1962. 62p.

A flexible external beam system is proposed in which focal spots suitable for target location may be provided at any convenient point along the path through the experimental area. A target spot close to the machine, in front of the main shield wall, is also provided. The beam transport problem is solved in terms of widely-separated singlet quadrupole elements, and matching problems are solved using quadrupole doublets. It is shown that target spot sizes of order $\frac{1}{8}$ to $\frac{1}{4}$ in. should be feasible, provided that the achromatic extraction system performs satisfactorily. (auth)

21650 (NP-11624) A SURVEY OF NEUTRAL PARTICLES IN A 30° BEAM FROM THE BROOKHAVEN ALTERNATING GRADIENT SYNCHROTRON OPERATING AT 30 Bev. Technical Report No. 39. H-J. Gerber, G. Fisher, R. Jones, and A. Wattenberg (Illinois. Univ., Urbana). May 1962. 16p. Contract ONR 1834(05).

The gamma spectra were measured. There were about $1.8 \pm 0.3 \times 10^9$ gamma rays with energies greater than 1 Bev per steradian at 30° from a 30 Bev proton beam of 10^{11} protons which was making multiple traversals of a carbon (or polyethylene) target. The number of gamma rays with energies greater than 3 Bev was down a factor of 10^3 from the number at 1 Bev. The number of high energy neutrons (greater than 300 Mev) coming through 2 inches of lead was about 5×10^9 neutrons per steradian per 10^{11} protons. If the lead was removed there would be about 8×10^9 neutrons per steradian per 10^{11} protons. Attempts were made to determine the number of K_2^0 mesons; however, the detection efficiency was very dependent on the nature of the weak decay interaction. If a vector interaction was assumed, it was indicated that there are about 1.2×10^9 K_2^0 mesons with energies above 1 Bev per steradian per 10^{11} circulating protons. (auth)

21651 (SIT-P53) THE CAPTURE OF PARTICLES INTO STABLE BETATRON ORBITS. S. J. Lukasik, K. C. Rogers, G. W. Zepko (Stevens Inst. of Tech., Hoboken, N. J.); and G. Brucker (Army Signal Research and Development Lab., Fort Monmouth, N. J.). [Jan. 1962]. Contract DA-36-039-SC-87242. 29p. (AD-270433).

Numerical calculations of the single particle trajectories of low energy electrons during the start-up phase of the operation of a betatron were performed. The conditions necessary for capture into a stable orbit were examined; these have included the effect of the initial position of the electron, the depth of the vector potential well, the rate of rise and the strength of the betatron field, and the allowable initial energy of the particle. It is shown, for example, that for a betatron having a 5 cm orbit radius, a peak magnetic field of 5 weber/m^2, a 1 μsec rise time, and a 1% vector potential well-depth, essentially all electrons having energies up to 10 ev will be captured. However, for substantially weaker or for more slowly rising magnetic fields, capture depends strongly on the initial particle energy, and on the depth of the vector potential well. (auth)

21652 (TID-15417) PERTURBATION EFFECTS ON ELECTROMAGNETIC CAVITY RESONATORS, 1941–1957. A Bibliography. Bettina Hoerlin, comp. (Los Alamos Scientific Lab., N. Mex.). July 29, 1957. Contract [W-7405-Eng-37]. 12p. (D-BIB-7).

Sources for the references include Science Abstracts, Los Alamos Scientific Report Library Catalog, and Los Alamos Scientific Laboratory Main Library Catalog. (J.R.D.)

21653 CERN AND HIGH-ENERGY PHYSICS. PART II. V. F. Weisskopf. CERN Courier, 2: No. 3, 6-8(Mar. 1962). (In English)

The facilities of CERN are described, and its role in European high-energy physics is discussed. Trends and possible future developments are mentioned. (L.N.N.)

21654 250 kv COCKCROFT-WALTON ACCELERATOR AS A 2.5 Mev NEUTRON SOURCE. Yun-kwei Tai and Yuen-chi Hsu (National Taiwan Univ., Taipei, China). Ho Tsu K'o Hsueh, 2: 3-9(1960). (In Chinese)

Monoenergetic neutrons at 2.5 Mev were produced by bombarding a target of frozen D_2O with high energy deuterons from a 250 kv Cockcroft-Walton accelerator. At a deuteron energy of 190 kv and a deuteron current of 250 μA, a neutron source equivalent to 8.2 g Ra–Be was obtained. The average yield was 0.52×10^6 neutrons/sec/μA. The setup is described in detail with the aid of diagrams. A graph showing the relation between neutron production and its equivalence to Ra–Be in g as a function of deuteron energy is given. (TTT)

21655 1-MV CASCADE GENERATOR FOR THE ACCELERATION OF PROTONS AND DEUTERONS. A. Eckardt, G. Goetz, E. Greiner, A. Kriester, J. Mittenbacher, and R. Prager (Friedrich-Schiller Universität, Jena, Ger.). Kernenergie, 5: 90-7(Feb. 1962). (In German)

The construction of a 1-Mv Cockcroft-Walton generator and the coupled acceleration plant is described. Construc-

tion units of the accelerator and the necessary supplementary apparatus are reported. The installation yields an 850-kv ion beam of 400 μamp. Measurements of various (p,γ) reactions were used for testing the operational behavior. (tr-auth)

21656 THE DISSOCIATION OF H_2^+ and H_3^+ IONS IN AN ACCELERATION TUBE. K. H. Krebs and E. Zilinski (Kernphysikalisches Institut der Deutschen Akademie der Wissenschaften, Berlin and Forschungsgemeinschaft, Zeuthen, Ger.). Kernenergie, 5: 98-103(Feb. 1962). (In German)

Pulse spectra, which occurred from the decay products of H_2^+ and H_3^+ ions in an accelerator tube, were observed. The origin of the individual peaks in the spectrum is discussed. (tr-auth)

21657 ASSEMBLY AND OPERATION OF A 300 kev ELECTROSTATIC NEUTRON SOURCE. G. Bonazzola, P. Brovetto, E. Chiavassa, and S. Ferroni (Università, Turin and Istituto Nazionale di Fisica Nucleare, Turin). Nuovo cimento (10), 23: Suppl. No. 1, 67-74(1962). (In English)

A 300-kev electrostatic ion accelerator for the production of fast neutrons is described. A special target assembly permits the α particles from the $T(d,n)He^4$ reaction to be utilized for coincidence work and for monitoring. A silicon junction detector is used; results of different measurements of the neutron flux are given. (auth)

Plasma Physics and Thermonuclear Processes

Refer also to abstract 20607.

21658 (AD-265829) SOME THETA PINCH EXPERIMENTS. Mitchell H. Dazey and Stanley L. Leonard (Aerospace Corp. Physical Research Lab., El Segundo, Calif.). Aug. 18, 1961. Contract AF04(647)-594. 28p. (TDR-594 (1208-01)TR-4).

The theta pinch was studied in an apparatus which generates a 10,000-gauss magnetic field parallel to the axis of a cylindrical pinch tube. The field rises to full value in about 1.5 micro seconds and remains virtually constant for 7 micro seconds. The compression of a strongly pre-ionized deuterium plasma by the applied field and the subsequent radial oscillations of the plasma column were observed by means of magnetic probes, streak photography, and Kerr cell photography. Outward radial streaming of the plasma was observed in a configuration suggesting the flute instability. Axial streaming of the plasma out the ends of the drive strap was also detected. The radial oscillation frequency and the time of arrival of the incoming plasma surface at a prescribed radius were compared with predicted values based on phenomenological theories. (auth)

21659 (AD-267135) THE USE OF A LOW TEMPERATURE, NONEQUILIBRIUM PLASMA JET AS A PLASMA SOURCE FOR ADVANCED PROPULSION SYSTEMS. A FEASIBILITY STUDY. J. B. Wilkinson (AeroChem Research Labs., Ind., Princeton, N. J.). Mar. 1961. Contract NOnr-2773(00). 30p. (AeroChem-TP-34)

A low temperature nonequilibrium plasma jet facility was studied as a plasma source for space propulsion systems and found to be a much more efficient means of utilizing electrical energy to produce a plasma than the conventional plasma arc jet. Ion loss mechanisms in the jet stream are discussed. Preliminary ion decay measurements lead to the conclusion that the faster ion-loss mechanism (dissociative recombination) is not operative and that the dominant loss mechanism is by diffusion and thus will become less significant as the jet diameter is increased. Attempts to set up a BxJ accelerator channel around the plasma jet were made, but the results obtained were inconclusive. (auth)

21660 (AD-271170) PLASMA PHYSICS AND MAGNETOHYDRODYNAMICS. An ASTIA Report Bibliography. Merrill F. Aukland, comp. (Armed Services Technical Information Agency, Arlington, Va.). Mar. 1962. 271p.

The citations presented cover the period from 1953 to early 1962 which coincide with the period of greatest development in these fields. Although many references may be related to more than one category they appear only once under the subject area best indicated in the report. In addition to the general references on theory, analysis, and instrumentation, entries are included on electron–ion collisions, electromagnetic waves, gas ionization, magnetic pinch effects, microwaves, plasma jets, plasma sheaths, propellants and propulsion, oscillations, nuclear applications, re-entry aerodynamics, shock waves and shock tubes, and solar and extraterrestrial effects. Entries are arranged alphabetically by subject and by AD number within each subject. (auth)

21661 (AFCRL-746) STUDIES IN NON-LINEAR MODELING. III. ON THE INTERACTION OF ELECTROMAGNETIC FIELDS WITH PLASMAS. Final Report. Kun-Mu Chen, R. E. Kleinman, J. Meixner, O. G. Ruehr, and D. Sengupta (Michigan. Univ., Ann Arbor. Radiation Lab.). July 31, 1961. Contract AF19(604)-7428. 144p. (AD-267391).

Results of an investigation of the interaction of electromagnetic fields with plasmas, including the development and use of appropriate non-linear modeling techniques, are presented. Expressions for density distributions in the sheath and potential induced on a conducting plate in the presence of a plasma (moving or stationary) are found. The potential at one temperature in the sheath is non-linearly modeled to give the potential at another temperature. Correction terms are found for the standard treatments of the interaction of electromagnetic fields with collisionless plasmas and weakly ionized gases. These corrections are functions of field intensity and give significant results for high intensity fields. The current induced in the plasma with a low intensity field is non-linearly modeled to the high intensity case. Expressions for the conductivity (both a-c and d-c) are found for various plasmas and incident field intensities. (auth)

21662 (AFSWC-TDR-62-42) THEORETICAL HYDROMAGNETIC SHOCKS. F. Ek, W. Knabe, P. Koch, and S. Ziering (Allied Research Associates, Inc., Boston). Apr. 1962. Contract AF 29(601)-2816. 107p.

Three papers are presented on the mathematical description of magnetohydromagnetic shock waves. Two of these papers, for which separate abstracts were prepared, deal with the mean-free-path definition in the Mott-Smith shock wave solution and shock waves in a plasma in the presence of a weak magnetic field, respectively. The remaining paper, previously abstracted in NSA, develops a two-fluid model of neutral shock waves. (D.L.C.)

21663 (ARL-62-310) STUDY OF A SEEDED PLASMA. Robert S. Bushman (Michigan. Univ., Ann Arbor). Mar. 1962. Contract AF33(616)-8126. 117p.

An investigation was conducted to study the method of increasing the electrical conductivity of a gas by intro-

ducing a foreign element into the gas flow and to determine the properties of the resulting plasma. The important chemical reactions which take place when a fluid is seeded were analyzed as a function of temperature and pressure. The seeding elements considered were the alkali metals, alkaline earths, and Al. The elements were selected on the basis of their relatively low ionization potential. The fluids considered were air, oxygen, and nitrogen, although the results are applicable to any fluid. The theoretical ionization process was developed including the excited electron energy states. The simultaneous solution of the governing equations resulted in a quadratic equation giving the free electron concentration of the seeded fluid. (auth)

21664 (D1-82-0155) THE KINETIC THEORY OF QUANTUM PLASMAS. Ralph L. Guernsey (Boeing Scientific Research Labs., Seattle). Apr. 1962. 27p.

A unified theory of equilibrium and non-equilibrium quantum plasmas is presented, using an approach originally developed by Bogoliubov. The results, which are valid in both high temperature-low density and (for Fermi gases) low temperature-high density regions, include: an expression for the equilibrium correlation function (and hence the thermodynamic functions) which agrees with results previously obtained by other methods, the kinetic equation for homogeneous "steady state" systems derived by Balescu using a different approach, and a kinetic equation which is valid for inhomogeneous and/or rapidly varying systems. (auth)

21665 (NP-11649) WAVE MOTION IN A PLASMA WITH ANISOTROPIC PRESSURE. R. K. Jaggi (Maryland. Univ., College Park. Inst. for Fluid Dynamics and Applied Mathematics). Feb. 1962. Contract NsG 220-62. 62p. (BN-278)

The moment equations, neglecting the heat flow tensor were used, to study the wave propagation in a plasma consisting of electrons and singly charged ions, in a magnetic field, with anisotropic pressure tensors for both components. Two cases of wave propagation along the magnetic field and perpendicular to it were worked out separately. In the first case of propagation along the magnetic field, the waves separate into a pure longitudinal and a pure transverse wave, the second of these only being affected by the anisotropy of the pressure tensor. Conditions were deduced under which the anisotropy of the pressure tensor can alter the propagation conditions of the waves. Attention was also given to the possibility that it can give rise to an instability. One important result which followed for magnetohydrodynamic waves was that an anisotropy in the electron pressure can give rise to an instability of the Alfven waves. In the other case of the propagation across the field, the waves separate into a pure transverse wave and a wave which represents a combined longitudinal and transverse wave. The second of these was unaffected by the anisotropy of the pressure tensor and, under simplifying assumptions, a dispersion equation was obtained which was the same as that obtained by Gross from the Boltzmann equation. For the pure transverse wave, conditions were obtained under which instability can arise. (auth)

21666 (RISÖ-35) RELAXATION PHENOMENA BEHIND A STRONG SHOCK IN HYDROGEN. I. ATTAINMENT OF THE VIBRATIONAL EQUILIBRIUM STATE. C. T. Chang (Denmark. Atomenergikommissionen. Forsøgsinstitut, Risø). Feb. 1962. 28p.

The time required to establish the equilibrium states of translational, rotational and vibrational degrees of freedom of the gas behind a strong shock in hydrogen are estimated. It is shown that when $T < T_v^*$, (where $T_v^* = (h\nu/k)$), translational and rotational degrees of freedom reach their equilibrium states much faster than that of the vibrational degrees of freedom. The relaxation time of the translational and the rotational degrees of freedom are of the order of magnitude of the gas kinetic collision time; the relaxation time of the vibrational degrees of freedom possibly is of the order of magnitude given by the existing quantum theory of Herzfeld and Schwartz. When $T > T_v^*$, the Herzfeld-Schwartz theory breaks down. Simple consideration, based on the adiabaticity concept of the collision processes, indicates that possibly at such a temperature range all the three modes reach their equilibrium states at essentially the same rate. (auth)

21667 (TID-15504) PLASMA PHYSICS LECTURE NOTES, CHAPTER V. George Schmidt (Stevens Inst. of Tech., Hoboken, N. J.). Summer 1961. Contract AT(30-1)-2813. 69p. (SIT-P59(3/62))

Chapters I-IV identified as NP-9741.

The fundamental properties of plasmas in the steady and quasi-steady states are discussed. Electric fields in plasmas, plasma motion in magnetic fields, plasma confinement by magnetic fields, the plasma-magnetic field boundary, the E-layer, plasma confinement in high-frequency fields, and quasi-steady processes are considered. (M.C.G.)

21668 (AERE-Trans-893) MEASUREMENT OF THE ELECTRON TEMPERATURE OF THE PLASMA IN A STRONG SHOCK WAVE. T. I. Filippova, N. V. Filippov, V. V. Zhurin, and V. P. Vinogradov. Translated by A. N. Dellis (U.K.A.E.A. Atomic Energy Research Establishment, Harwell, Berks, Eng.) from Nuclear Fusion, 1: No. 3, 195-7(1961). 11p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 15, abstract no. 32868.

21669 THE THETA PINCH DEVICE OF THE ELECTROTECHNICAL LABORATORY IN JAPAN. Tasaburo Yamada, Shuichiro Kawamata, Kiyoshi Ogawa, Masaru Sugiura, Shuko Aihara, et al. Denki Shikensho Iho, 26: 131-46(Feb. 1962). (In English)

Two coils are wrapped around a glass cylinder to produce a rapidly rising magnetic field in a mirror geometry. The cylinder thus formed is 5 cm in diameter and 50 cm in length and is filled with air or deuterium to some known pressure between 0.4 and 0.001 mm mercury. The total plasma current is measured with a Rogowski coil inserted in the center of the cylinder. The wave form of current in plasma is very different from that of the primary current. In order to determine the behavior or the confinement time of plasma, the light beams from the plasma in radial and axial directions, and the light from the main gap are guided to a streak camera simultaneously. The total number of neutrons emitted during one discharge is detected with an activation counter. The electron density in the plasma is observed with the 35-Gc band microwave apparatus. Based on experiments and magnetohydrodynamical assumptions, theoretical analyses of phenomena occurring in plasma during discharge are examined. (auth)

21670 THE STABILITY OF A PLASMA CYLINDER WITH INHOMOGENEOUS, CROSS-SECTIONAL DISTRIBUTION OF CURRENT. Yu. V. Vandakurov (Ioffe Technical Inst., Academy of Sciences, USSR). Doklady Akad. Nauk S.S.S.R., 143: 1078-81(Apr. 11, 1962). (In Russian)

The medium within a plasma cylinder of radius a is nonviscous, incompressible, and ideally conducting. The perturbation as a function of time, ϕ, and z is taken in the form of exp $[i(\omega t + m\phi + kz)]$. A linearized set of equations for

the magnetic hydrodynamics is written involving the terms $s = (a/H_0)[(mH_\phi/r) + kH_z]$ and $\Omega^2 = 4\pi\rho a^2\omega^2/H_\phi^2$. An investigation is made of long-wavelength disturbances with $m > 1$ so that $|ka| \ll 1$. The unknown terms are expressed by $X = r\xi_r$, where r is the variable radius and $\xi = v/i\omega$. An equation is developed that is expressed by a single-parameter family of curves in $s_0(b)$, where $s_0 = m + kah$ and $b = kahl/m$. The term $m\ln(a/d) = (s_1 - s_0)/b$ can be taken as a parameter. At $a = d$ the instability takes place in the band $0 < s_0 < 1$. The curves $s_0(b)$ are shown graphically for the case $m\ln(a/d) < \frac{1}{4}$. The regions of instability are also shown. (TTT)

21671 DETERMINATION OF MEAN VELOCITY AND CONCENTRATION OF PARTICLES IN HIGH-SPEED RAREFIED PLASMA FLOW. V. B. Cherenkov, O. Yu. Sevast'yanov, and Yu. M. Lukyanov. Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk, Mekh. i Mashinostr., No. 2, 25-9(Mar.-Apr. 1962). (In Russian)

A method was developed for determining mean particle density and velocity in rarefied high-speed plasma flow. In one experiment the mean values were $7.4 \times 10^{11}/cm^3$ 37 km/sec. The method allows the determination of flow rates from a few up to several hundred km/sec at particle concentration from 10^8 to $10^{15}/cm^3$. The method is based on the simultaneous measurement of the number of particles passing through a given cross-section in a unit of time and the force of the particles on a solid with a given resistance coefficient. (R.V.J.)

21672 STATIONARY MOTION OF HIGH-TEMPERATURE PLASMA. V. S. Tkalich (Inst. of Physics and Tech., Academy of Sciences, Georgian SSR). Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk, Mekh. i Mashinostr., No. 2, 30-7(Mar.-Apr. 1962). (In Russian)

A system of nonlinear differential Boltzmann equations and differential Maxwell equations describing a plasma in self-consistent electromagnetic field, in the presence of cyclic coordinates and other supplementary limitations, was reduced to a system of quasi-linear differential equations. Moreover, the distribution function is an arbitrary function of the characteristic system of primary integrals, which are analogous to the symmetry integrals of charged particles in external electromagnetic field. Analogous Maxwell distribution functions are used for studying magnetic wall isolation properties. (R.V.J.)

21673 OPTICAL REFRACTIVITY OF FREE ELECTRONS. S. A. Ramsden and E. A. McLean (Naval Research Lab., Washington, D. C.). Nature, 194: 761-2 (May 26, 1962).

The optical refractivity of free electrons in a hydrogen plasma with 100% ionization was measured along with the Stark effect broadening of H_β and H_γ and the absolute continuum intensity. The electron density was calculated from the refractivity and found to agree with the values from the H_β and H_γ lines and the continuum. (D.L.C.)

21674 ION WAVES IN A BOUNDED PLASMA. P. F. Little (Culham Lab., Oxfordshire, Eng.). Nature, 194: 1137-9(June 23, 1962).

Experiments were carried out on the transmission of low-frequency ion waves in the direction of the electron drift along a mercury arc column, with and without an axial magnetic field. The waves were excited by a short exciter coil wound around the column or by modulation of the ionization rate with a pair of grids. The wavelength was observed to increase as the frequency was reduced, and below a critical frequency no waves appeared. Comparison of the observed cut-off frequencies and electron temperatures with those calculated with a two-fluid treatment of waves in a plasma show that these ion waves have higher phase velocities than in an infinite medium. (D.L.C.)

21675 MAGNETIC PROPERTIES OF A RELATIVISTIC ELECTRON GAS. S. Visvanathan (General Electric Valley Forge Space Tech. Center, Penna.). Phys. Fluids, 5: 701-4(June 1962).

The magnetic properties of a relativistic electron gas were studied by evaluating the magnetic moment of an assembly of relativistic electrons in a constant magnetic field. The diamagnetic contribution is found to be a third of the spin paramagnetism as in the nonrelativistic case. Results agree with those deduced from the perturbation theory in quantum mechanics. (auth)

21676 KINETIC EQUATIONS FOR PLASMAS. Toyoki Koga (Univ. of Southern California, Los Angeles). Phys. Fluids, 5: 705-11(June 1962).

The effect of the inner-core field induced by a charged particle within the Landau distance and neglected in kinetic theories of plasmas is investigated from the transport-theory viewpoint. In the equation for a one-particle distribution function, the effect of the outer-core field between the Landau distance and the Debye distance is represented by the friction and diffusion terms of the Fokker-Planck type, while the effect of the inner-core field by the collision term of the Boltzmann type. The magnitudes of these terms are compared. The collision term may be larger than the friction and diffusion terms under certain conditions. When the effect of the outer-core field is larger than that of the inner-core field, the assumption of weak interaction is not valid. The possible nonlinear and non-Markovian behavior of a particle is considered only implicitly. Radiation phenomena are neglected. (auth)

21677 CONFINEMENT OF A PARTIALLY IONIZED GAS BY A PERIODIC MAGNETIC FIELD. Bert Zauderer (Massachusetts Inst. of Tech., Cambridge). Phys. Fluids, 5: 720-9(June 1962).

Experiments were performed to test the confinement of a partially-ionized Ar plasma cylinder by a coaxial 67-kc magnetic field. The 10,000°K Ar plasmas were produced by a chemically-driven shock tube and by an electrodeless ring discharge. Smear photographs showed that the plasma was periodically compressed by the field at twice the field frequency. Magnetic probes showed that the plasma diameter was about 80% of the shock tube internal diameter and that the skin depth of the field was one-third the plasma radius. A similar ring-discharge experiment in hydrogen indicated that the speed of sound divided by the tube diameter must be small compared to the angular field frequency to obtain a steady continuous confinement of the plasma by the field. (auth)

21678 PLASMA CONFINEMENT BY DIRECT-CURRENT MAGNETIC FIELDS ASSISTED BY AN ARBITRARY EXTERNAL FORCE. D. G. Dow (Varian Associates, Palo Alto, Calif.). Phys. Fluids, 5: 730-6(June 1962).

The equations for confinement of an isotropic plasma are formulated to include an arbitrary external force, which can be assumed to be provided by radio-frequency fields. A restriction is found relating the possible forms of the magnetic field and external force. A d-c magnetic field in the absence of other forces cannot support a pressure gradient transverse to its radius of curvature; if the arbitrary external force is conservative, equilibrium can only be achieved when the external force just compensates the particle drift due to inhomogeneous magnetic fields at those points where the direct current is along the radius of curvature of the magnetic field. Stability problems are not

considered. The time dependent equation, from which they may be studied, is presented. (auth)

21679 METHOD FOR THE REMOVAL OF FREE ELECTRONS IN A PLASMA. Gerald Rosen (Martin-Marietta Corp., Baltimore). Phys. Fluids, 5: 737-8(June 1962).

Reduction of the free-electron concentration in a gas plasma is described. Free electrons are effectively absorbed by uniformly-distributed micron-size particles of a chemically-inert refractory material. Thermionic emission from the particles is assumed to be negligible. Due to the relatively large mean velocity of free electrons, a small concentration of refractory dust captures almost all electrons in a state of dust-plasma equilibrium. (L.N.N.)

21680 STABILIZATION OF FLUTE DISTURBANCES BY THE CORIOLIS FORCE. B. Lehnert (Royal Inst. of Tech., Stockholm). Phys. Fluids, 5: 740-1(June 1962).

Coriolis force effects on density perturbation stability in rotating plasma are discussed in terms of perturbations by which ionized matter moves across the magnetic field, simultaneously leaving the field unchanged. Results are connected with the Rayleigh-Taylor instability in hydrodynamics. (L.N.N.)

21681 ROTATION OF PLASMAS IN θ PINCHES. Norman Rostoker (General Dynamics Corp., San Diego) and Alan C. Kolb. Phys. Fluids, 5: 741-2(June 1962).

It is shown that the difference in "kinetic" and "canonical" angular momenta in plasma is negligible. (L.N.N.)

21682 TRANSPORT PROPERTIES OF PARTIALLY IONIZED GAS. V. M. Zhdanov. Priklad. Mat. i Mekhan., 26: 280-8(Mar.-Apr. 1962). (In Russian)

Expressions are derived for the viscosity and thermal particle fluxes in a three-component plasma (electrons, ions, and neutrals). An analysis is made of the generalized Ohm's law for the plasma considering thermal particle fluxes in diffusion formulas. An expression was also derived for the current along and across magnetic fields, including the conductivity at the expense of pressure and temperature gradients. (R.V.J.)

21683 RECOMBINATION BETWEEN ELECTRONS AND ATOMIC IONS. I. OPTICALLY THIN PLASMAS. D. R. Bates (Queen's Univ., Belfast), A. E. Kingston, and R. W. P. McWhirter. Proc. Roy. Soc. (London), A267: 297-312 (May 22, 1962).

Consideration is given to the interacting collisional and radiative processes occurring in a plasma. A statistical theory describing the general loss mechanism, for which the name collisional-radiative recombination is proposed, is described. This theory enables the collisional-radiative recombination coefficient α to be determined if the relevant spontaneous transition probabilities and the rate coefficients for radiative recombination and collisional excitation and ionization are known. Detailed calculations are carried out on optically thin hydrogen-ion plasmas. It is found that α is an increasing function of the number density of free electrons n(c), the increase being especially marked if the electron temperature T is low. For example, if T is 250°K α becomes almost 20 times as great as the radiative recombination coefficient (which describes the loss in a very tenuous plasma) when n(c) is only about $10^8/cm^3$, whereas if T is 64,000°K α does not become as great as this until n(c) is about $10^{18}/cm^3$. From a similar investigation in which the ground level of the hydrogen atom is made inaccessible (in crude representation of an alkali atom) it is inferred that the value of α is probably not very sensitive to the species of singly charged ion involved. Recombination of electrons with bare nuclei of charge Ze to form hydrogenic ions is similarly treated for an optically thin plasma. It is shown that to a close approximation the reduced coefficient α/Z is a function of a reduced temperature T/Z^2 and a reduced number density $n(c)/Z^7$ only. The values of the reduced coefficients are of comparable magnitude, and have a similar dependence of the reduced temperature and density, as the coefficients for hydrogen ion plasmas. The variation of α with Z for given n(c) and T is investigated. It is found that $\alpha \propto Z^z$ where the index z depends on n(c) and T. Though z is generally positive, it is negative if n(c) and T are very high. A physical explanation of this is presented. (auth)

21684 SPECTROSCOPIC STUDIES USING TIME-RESOLUTION TECHNIQUES. L. Bovey (Atomic Energy Research Establishment, Harwell, Berks, Eng.) and A. H. Gabriel. Spectrochim. Acta, 18: 631-54(May 1962).

A series of grafting and prism spectrographs and direct-recording spectrometers used to record spectra over the range 100 to 8000 Å at microsecond intervals or less are described. Studies were made of atomic spectra emitted by large-scale discharges such as occur in Zeta, Sceptre, Thetatron, Torus T.A. 2000, the ion injection machine (M.M.I.I.), and other smaller laboratory experiments with electron densities ranging from 10^{14} to 10^{18} cm^{-3} and temperatures 1 to 100 ev. Results are discussed in theories involving ionization, excitation, and recombination conditions within the plasma. The use of (and necessary apparatus for) time-resolved spectra in the spectrochemical analysis of copper alloys was also described. (auth)

21685 THE PENETRATION OF THE GLOW DISCHARGE INTO THE GAP. Wolfgang Ohlendorf (Universität, Bonn). Z. Physik, 167: 123-51(1962). (In German)

The fractional area of the cathode covered by the negative glow in low-pressure hydrogen discharges was studied using a special coplanar anode–cathode configuration. The cathode was a steel bar of 2 × 2 × 64 cm, sectionalized into 32 insulated parts. An identical electrode mounted directly above the cathode at a variable separation facilitated the simulation of screening effects of insulating or conducting walls and of hollow cathode conditions. The depth of penetration ξ of the discharge into this gap was studied for various conditions. In general for the insulating wall condition, ξ is approximately proportional to the applied voltage and depends on the gap width and pressure. The electron current in the negative glow parallel to the cathode surface as well as the cathode current density at any distance x from the anode vary exponentially with $\eta = \xi - x$. The potential of the negative glow in the gap decreases slowly with x to the "normal" cathode fall at $x = \xi$. In the case of the conducting wall, the discharge can penetrate to any depth, provided the wall is maintained at a potential $\geq$ the "normal" cathode fall. For a hollow cathode ξ is small, but the current density near the anode reaches extremely high values. (auth)

21686 ELECTRON AND ION SATURATION CURRENTS IN WEAKLY IONIZED GASES AT HIGH PRESSURES (AN EXPANSION OF THE LANGMUIR PROBE THEORY AT HIGH PRESSURES). Guenther Schulz (Universität, Saarbrücken, Saar, Ger.). Z. Physik, 167: 205-28(1962). (In German)

The electron saturation currents measured with the help of fine cylindrical probes at high pressures in the intermediate gas volume of methane–hydrogen–air flames can be described neither by the Langmuir equations nor the Borgnis probe theory. It was shown that the electrons in

the space charge, which at high pressures and low carrier densities completely shield the field of the probe, do not have a constant motion but one dependent on the field and therefore on the position in the space charge layer. It was also shown that in the divergent field of the space charge layer a relaxation of the electron energies occurs which may be neglected at infinitely high pressures. From this viewpoint, a characteristic current-voltage relationship was derived for the electron current at high pressures which permits an exact evaluation of the measurements for determination of the electron densities. The ion saturation currents can be described and evaluated with an equation by Borgnis. (tr-auth)

21687 THE THERMODYNAMIC EQUILIBRIUM IN SPARK PLASMAS. H. Krempl (Technische Hochschule, Munich). Z. Physik, 167: 302-25(1962). (In German)

A simple method was established to calculate the composition and the line emission of a thermal plasma. The influence of a second component, e.g., the vapor of electrodes in a spark discharge, can thus be accounted for. Thermal equilibrium was given experimental proof through the cooling curve of a short-time high current condensed discharge. To achieve this, a new spectroscopic method for high-temperature measurement was developed. This even works where oscillator strength is unknown. Moreover, the temperature value measured represents that of the plasma core. Temperature measurement involving different lines of different elements, i.e., of different atomic masses, will furnish similar results. This is evidence for thermal equilibrium existing in spark discharges. (auth)

21688 OSCILLATIONS OF A THREE-COMPONENT ASSEMBLY WITH OR WITHOUT MAGNETIC FIELD. C. Devanathan (Indian Inst. of Science, Bangalore). Z. Physik, 167: 337-48(1962). (In English)

The plasma is taken to be composed of singly ionized molecules, free electrons, and neutron molecules, each of the components being described by the hydromagnetic equations, modified to take into account the displacement current, existence of free charge in the medium, and the modified current equation without involving the scalar conductivity. The basic equations are linearized and only small amplitude waves are considered. In the absence of any external magnetic field, the transverse and longitudinal modes of oscillation separate out. In the transverse part a coupled plasma oscillation occurs which could be propagated only above a certain critical frequency and in the longitudinal part one extraordinary mode of propagation occurs having a forbidden range of frequencies. When there is an external applied magnetic field, ordinary and extraordinary waves are propagated along the direction of the magnetic field, whereas only ordinary waves are propagated transverse to the magnetic field. The critical frequencies above which these waves are propagated are evaluated and the possible explanation of this medium-like behavior could be the implicit assumption of conductivity being not a scalar. (auth)

21689 PLASMA CAPACITOR. (to U. S. Atomic Energy Commission). British Patent 898,503. June 14, 1962.

A plasma-type capacitor is designed which is useful for the storage and rapid discharge of very large amounts of electrical energy. The capacitor comprises an input line, an output line, a pair of concentric electrodes defining a chamber, and means for establishing within the chamber a high-intensity rotating disc of plasma with a high dielectric constant. A switch may be connected to the output line for discharging the plasma energy across a load. (D.L.C.)

Shielding

Refer also to abstract 20241.

21690 (AD-267561L) DEVELOPMENT OF A LIGHT-WEIGHT PLASTIC NEUTRON SHIELDING MATERIAL BASED UPON BORON COMPOUNDS WITH HIGH HYDROGEN CONTENT. Monthly Progress Report No. 3. W. H. Yanko and M. E. Ginn (Monsanto Research Corp. Dayton Labs., Ohio). Oct. 5, 1961. Contract DA-19-020-ORD-5458. 9p.

A literature survey was continued in a program to determine B compounds which have neutron shielding properties superior to B-containing polyethylene. A compilation is being made of all known B compounds containing elements with atomic numbers 1 through 20. A computer program is being developed for processing density data. (J.R.D.)

21691 (DC-60-7-9) PROGRAMS 20-2, -3, -4, AND -5 AUXILIARY PROGRAMS TO SHIELD COMPUTER PROGRAM 18-0. J. E. MacDonald, J. P. Yalch, and L. Almeleh (General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati). June 30, 1960. Contract AT(11-1)-171. 74p.

Basic cross section data were assumed available for program 20-2 in the form of tables of cross section versus energy for each event considered for each material considered. In addition, the desired energy group structure is specified as input. The program then approximates the basic cross section data by discontinuous straight line segments across each specified energy group. A trapezoidal integration is performed on basic cross section data to preserve group average. The "best slope" is determined by one or both of two methods. In Method A, the "best slope" is determined by taking the average of area weighted slopes of lines joining basic data points. The "best slope" in method B is determined by dividing the energy group into two equal half groups. The area of each half group is found. From these, the average cross section for each half group is computed and attributed to the energy at the center of each half group, respectively. A line connecting these two points is the "best slope." The appropriate cross sections for the end points of any group are then computed by using the "best slope" as found in either or both of methods A and B. Program 20-3 computes the total macroscopic cross sections of a composition, given the materials of the composition; the atomic weight, the volume fraction, and the density of each material within the composition; the microscopic cross sections as a function of energy, for each event and material, and the total macroscopic cross sections as a function of energy for each material. The ratio of the event macroscopic cross section for each material to the composition total macroscopic cross section is computed per energy. In program 20-4 it is assumed basic angular distribution data are given in one of two forms: if the Legendre coefficients which are a function of neutron energy in the laboratory system are given, the program first computes the average Legendre coefficients weighted by the elastic scatter cross section to total cross section, then forms the angular distribution density function using these weighted average Legendre coefficients and the Legendre polynomials, and a cumulative probability function is formed; and if the angular distribution density function is given, the program proceeds from that point as in (a). Program 20-5 determines a cumulative probability distribution table from the probability density distribution given by the evaporation model of the nucleus:

$f(E) = E^{-0.31\sqrt{(M)/(E_{in,j})}}\ E$, where M = mass of nucleus, and $E_{in,j}$ = incident neutron energy. (auth)

21692 (NP-11657) ATTENUATION OF GAMMA RADIATION IN A TWO-LEGGED 11-INCH RECTANGULAR DUCT. D. W. Green (Naval Civil Engineering Lab., Port Hueneme, Calif.). May 2, 1962. 52p. (R-195)

Results are presented of experiments carried out with an 11 × 11-in. duct in concrete with one right-angle bend, using Co^{60} as a gamma-ray source. Experiments cover the effects of moving the source and detector off the centerline position, of replacing the inside concrete corner lip with one of lead, and of removing various scattering areas in the corner. Measured values of attenuation factors for the corner and second leg are compared with calculated values, using the LeDoux-Chilton analysis. The comparisons suggest that the analysis provides an adequate treatment of the single-scatter effect in the duct. Multiple-scatter effects, however, which are not taken into account by the analysis, apparently are responsible for approximately half of the radiation reaching the detector. An empirical expression is obtained which adequately represents most of the experimental results of duct measurements available at the present time. (auth)

21693 (NP-11819) MONTE CARLO CALCULATIONS ON THE REFLECTION AND TRANSMISSION OF SCATTERED GAMMA RADIATIONS. Final Report. Dominic J. Raso (Technical Operations, Inc., Burlington, Mass.). July 1961. Revised, May 1962. 93p. (TO-B-61-39).

Monte Carlo calculations were performed to determine the back-scattering and the transmission of gamma rays having energies between 0.02 and 10.0 Mev from concrete. The radiation was assumed to be incident on a semi-infinite medium and on various slab thicknesses of 0.5, 1.0, 2.0, and 4.0 mfp at angles of cos Θ_0 = 1.0, 0.75, 0.50, 0.25, and 0.10. The case histories of 5000 photons were followed on the IBM 704 digital computer. The information obtained included: the characteristics of emergent photons, which were stored on magnetic tape; a routine that processes these characteristics to give polar and azimuthal angular dose distribution; and detailed results from the application of the processing routine to the parameters investigated. The computer program, the processing routine, and the results are appended. (auth)

21694 SHIELDING PROPERTIES OF DIFFERENT TYPES OF CONCRETE. E. Bashandy (UAR Atomic Energy Establishment, Cairo). Intern. J. Appl. Radiation and Isotopes, 13: 87-92(Feb. 1962). (In English)

From the shielding point of view, the mass absorption coefficients as well as the energy distribution of gammas at 0.14 to 1.32 Mev were measured in different types of concrete. The measurements were performed using a scintillation spectrometric technique. (auth)

21695 EXPERIMENTAL DETERMINATION OF THE ABSORPTION COEFFICIENTS OF GAMMA RAYS THROUGH DIFFERENT BARRIERS. E. Bashandy (United Arab Republic Atomic Energy Establishment, Cairo). Intern. J. Appl. Radiation and Isotopes, 13: 173-8(Apr. 1962). (In English)

The absorption coefficients of gamma rays from 0.14 to 2.76 Mev, for six materials of different atomic number ranging from 6 to 82 were determined. The experiments were performed using a gamma scintillation spectrometer. The areas under the photoelectric peaks as well as their heights were used for calculating the absorption coefficients. A detailed comparison between experimental and theoretical results is discussed. (auth)

21696 ENGINEERING AND PHYSICAL CALCULATION OF BIOLOGICAL PROTECTION AGAINST RADIATIONS FROM NUCLEAR REACTORS (REVIEW ARTICLE). D. L. Broder and K. K. Popkov. Inzhener.-Fiz. Zhur., Akad. Nauk Belorus. S.S.R., 4: No. 12, 118-30(Dec. 1961). (In Russian)

Creation of a light, compact, and economical biological shielding system assumes great importance as reactors are being used to a greater extent as a source of energy. The radiations encountered in an operating reactor are classified as primary radiations, originating directly from the fission process and including fission neutron fluxes, instantaneous γ radiation, delayed γ radiation, and delayed neutrons. More than 50% of the fission neutrons undergo radiative capture, yielding γ radiation, the energy of which may reach 10 Mev. In the case of closed-circuit heat transfer, the activation process must be taken into account in the shielding design; for water-cooled reactors this effect is due to the reactions of the O isotopes, $O^{16}(n,p)N^{16}$ and $O^{17}(n,p)N^{17}$. The fast neutron flux is often determined by the removal cross section; however, the spatial distribution and the energy spectrum of the intermediate low-energy neutron flux cannot be determined by semiempirical methods and the kinetic equation must be solved. The theoretical principles of the attenuation of γ radiation in the shielding materials are derived and the experimental confirmation of the equations is described. 51 references. (TTT)

21697 THE ATTENUATION CURVE IN LEAD OF GAMMA-RAYS FROM I^{131} AND SOME CAUTIONS IN ITS MEASUREMENT. Nobuyoshi Muta and Kazuo Morita (Sapporo Medical Coll.). Sapporo Igaku Zasshi, 19: 250-2 (Apr. 1962). (In English)

Data on the attenuation in lead of γ from I^{131} were obtained, and the curve was drawn with the intent of planning protection, etc. (L.N.N.)

Theoretical Physics

21698 (AFOSR-2400) ANALYTICITY IN COMPLEX ANGULAR MOMENTUM OF THE RELATIVISTIC S-MATRIX. A. O. Barut and D. E. Zwanziger (California. Univ., Berkeley). [1962]. Contract AF49(638)-327. 9p.

Analyticity of the positions $\alpha n(q^2)$ and residues $Bn(q^2)$ of Regge poles as a function of energy was established, in the relativistic case, on the basis of the Mandelstam representation and unitarity. The two-body elastic scattering amplitude for equal mass spinless particles was considered. (M.C.G.)

21699 (CERN-62-15) RELATIVISTIC QUANTUM MECHANICS. LECTURES GIVEN AT M.I.T. IN 1953/4. Victor F. Weisskopf (Notes prepared by A. Bincer) (European Organization for Nuclear Research, Geneva). Mar. 30, 1962. 151p.

An introduction is presented to fundamental concepts concerned with the Dirac spinning electron equation. Special emphasis is placed on the concepts of angular momentum, spinors, and the two-spinor wave function which is the Dirac electron. (J.R.D.)

21700 REST ENERGY, REST MASS, AND NONCOVARIANT ELECTRODYNAMICS. J. S. Bell (European Organization for Nuclear Research, Geneva). Nuovo cimento (10), 24: 554-6(May 1, 1962). (In English)

A theory introducing a nonlocality not Lorentz-invariant was proposed to eliminate field-theory divergences. The theory retains charge conjugation and parity-chirality-time; mass is the same for positrons and electrons. The

energy balance in positron-electron annihilation is used to verify mass constancy for low momenta. (L.N.N.)

21701 REPRESENTATIONS OF DIRAC EQUATION IN GENERAL RELATIVITY. C. G. de Oliveira and J. Tiomno (Centro Brasileiro de Pesquisas Físicas, Rio de Janeiro). Nuovo cimento (10), 24: 672-87(May 16, 1962). (In English)

After a reformulation of the general relativistic equations of motion of a point mass in a gravitational field in terms of the so-called "fourlegs" expression for the gravitational potential, the generalized Dirac equation is written in the Schrödinger representation and the equations of motion of classical observable quantities compared with the "fourlegs" results. The Foldy-Wouthuysen representation is obtained in the presence of gravitational fields. The gravitational "gyromagnetic" factor is found to be 1 instead of 2 as the electromagnetic one. The interpretation of this fact is that the spinor field (and probably all fields) describes rotating particles, whereas the gravitational mass has exactly the same space distribution as the inertial mass. This is not true in linear theory. Finally, the red shift of hydrogen atom levels in the presence of a gravitational field is obtained, and found to coincide with the prediction of general relativity. (auth)

21702 THE GENERAL UNITARITY TERM. R. W. Lardner (Columbia Univ., New York). Nuovo cimento (10), 24: 763-4(May 16, 1962). (In English)

If M_1 and M_2 represent amplitudes for processes from states m to l and l to n respectively, and if for fixed energies of these states singularities exist at values $\{\rho_1\}$ and $\{\rho_2\}$ in the rotations from frames fixed with respect to the in-going momenta to frames fixed with respect to the out-going momenta, and if the singular rotations are supposed to lie on surfaces $S(R_1)$ and $S(R_2)$ in rotation space, then the singularities in the unitary combination of M_1 and M_2 are determined on the set S(R). S(R) is a set that fills out the six-space defined by $R = R_1R_2 \pm [(R_1^2 - 1)(R_2^2 - 1)]^{1/2}$. (T.F.H.)

21703 THE EFFECT OF VELOCITY DEPENDENT FORCES IN NUCLEAR MATTER. A. M. Green (Univ. of California, San Diego, La Jolla). Phys. Letters, 1: 136-8 (May 15, 1962). (In English)

Current nucleon-nucleon potentials were used to calculate the average energy of infinite nuclear matter by applying ordinary perturbation theory. Potentials obtained were complicated by the need for tensor and spin orbit forces in the triplet states, and the second-order perturbation contribution of the velocity-dependent forces to the energy of the nuclear matter was incomplete. These defects are remedied by considering the hypothetical case of a system of particles interacting through a potential that is spin dependent and acts only in s states. All of the second-order perturbation contribution can be calculated. (L.N.N.)

21704 ANGULAR MOMENTA IN RELATIVISTIC THREE-BODY SYSTEMS. B. Barsella and E. Fabri (Università, Pisa, Italy and Istituto Nazionale di Fisica Nucleare, Pisa, Italy). Phys. Rev., 126: 1561-2(May 15, 1962).

An elementary but rigorous treatment of the addition of relativistic angular momenta for three-particle systems in their center-of-mass reference frame is given. Canonical variables are defined, in terms of which the usual nonrelativistic formulas hold true. An application is made to the analysis of a T = 0 three-pion resonance. (auth)

21705 STRUCTURE-INDEPENDENT ELECTRODYNAMICS IN THE ELECTRIC-DIPOLE APPROXIMATION. Ralph Schiller and Melvin Schwartz (Syracuse Univ., N. Y.). Phys. Rev., 126: 1582-8(May 15, 1962).

The problem of a nonrelativistic charged particle interacting with its own field is treated by a method originally devised by Kramers. It is shown that the ambiguities which arise in Kramers' theory vanish when one utilizes a canonical scheme which explicitly deals with the constraints (relations among the dynamical variables) which arise in the course of mass renormalization. To create a consistent canonical theory in the presence of these constraints, it is convenient to introduce new dynamical variables which no longer satisfy the canonical commutation rules. It is shown that, if one accounts for the constraints, several different renormalized theories are related to each other by canonical transformation, and that each of these theories may be derived from a given unrenormalized theory by a canonical transformation. (auth)

21706 NEW SCATTERING APPROXIMATION. Henry Brysk (Adelphi Coll., Garden City, N. Y.). Phys. Rev., 126: 1589-95(May 15, 1962).

The spherical-harmonics decomposition of the wave equation for scattering of a plane wave by a potential of arbitrary space dependence is derived from the Green's function formulation. An approximation is then introduced which reduces the scattering problem to the solution of a set of coupled linear equations for the partial-wave amplitudes. The numerical coefficients in these equations involve Clebsch-Gordan coefficients and integrals over all space of a product of a spherical-harmonic component of the potential with a pair of Bessel functions. For central potentials (U), the equations decouple, and the phase shifts reduce to

$$\tan\delta_l = \frac{-k\int_0^\infty r^2 dr\ j_l^2(kr)U(r)}{1-k\int_0^\infty r^2 dr\ j_l(kr)y_l(kr)U(r)}.$$

While the manipulations involved resemble those in the Born approximation (the numerator above is the Born δ_l), the concept of the new approximation is quite different and the results can be very dissimilar. Exact and approximate phase shifts are exhibited for various spherical wells and barriers. For repulsive potentials, the approximation works well for short to moderate ranges ($ka \lesssim 2$) regardless of barrier height. For attractive potentials, comparable results are obtained for the "potential scattering," but the resonances are ignored. (auth)

21707 SPIN MATRIX EXPONENTIALS AND TRANSMISSION MATRICES. L. Young (Stanford Research Inst., Menlo Park, Calif.). Quart. Appl. Math., 19: 25-30(Apr. 1961).

The three Pauli spin matrices σ_i (i = 1, 2, 3) occur in the mechanical, especially quantum mechanical, theory of rotation in three-dimensional space. The three spin matrix exponentials are defined as exp (σ_i, x), where x is the independent variable. Transmission matrices can be expressed in terms of spin matrix exponentials, thereby permitting a more systematic treatment of transmission line circuits. (auth)

21708 THE REPRESENTATION OF SPINORS. Egil A. Hylleraas (Universitetet, Oslo). Z. Physik, 167: 243-9 (1962). (In German)

Spinor matrices were compiled which often lead to a useful auxiliary. This is connected with the possibility of expressing the spinors in the form of well-known widely disseminated matrices such as α and σ. (tr-auth)

21709 ON THEORY OF RADIATION IN MATRIX FORM THEORY OF CRYSTAL DIODE. Nagatoshi Tunazima. Tokyo, Sanshusha Press, 1962. 96p.

The relations between quantum mechanics and general

relativity are investigated, and used to deduce some of the properties of a quantum-mechanical theory of electromagnetic waves and a unified theory of general relativity. Solutions of the wave equations in the quantum theory are sought. Calculations of the unsymmetrical field tensor are presented, as are calculations of wave velocities in matter. The theory developed is used to produce an outline of the theory of the crystal diode. (T.F.H.)

REACTOR TECHNOLOGY

General and Miscellaneous

Refer also to abstracts 20303, 20577, 20592, 20692, and 20863.

21710 (AEET/RE/1) THE FAST FISSION FACTOR, AVERAGE AGE TO THERMAL, AND EFFECTIVE DELAYED NEUTRON FRACTIONS IN HETEROGENEOUS LATTICES. V. C. Deniz (India. Atomic Energy Establishment, Trombay). Oct. 30, 1961. 28p.

The period-reactivity relationship for a heterogeneous bare pile was derived from the kinetic equations, making a detailed study of the magnitudes of the different types of fast neutron sources available for slowing down into the thermal group. As a result, explicit expressions were obtained for the effective delayed neutron fractions and for the fast non-leakage probability which should be used in the definition of k_{eff} in order to satisfy the condition of zero reactivity at an infinite period. As a consequence, formulas for the fast fission factor and the age to thermal, to be used in lattice calculations, are proposed. The fast fission factor was derived according to Spinrad's definition of it as the number of neutrons effectively injected into the moderator per neutron born in thermal fission. The different types of fast neutrons considered are grouped as prompt neutrons above the fast fission threshold of U^{238}, prompt neutrons below the threshold, prompt neutrons from above the threshold which have been inelastically scattered, delayed neutrons of U^{235} and U^{238} fissions, and photoneutrons, if any. Numerical comparisons were made between values of the fast fission factor and the age, as given by the above formulations, and by existing formulations. It is noted, in particular, that the age to thermal, as given by the formulation of this report, is significantly lower than that given by the usual formulas. (auth)

21711 (AEEW-M-225) SOME CALCULATIONS OF SODIUM REACTIVITY EFFECTS IN A DILUTE FAST REACTOR. J. Codd, C. Durston, and M. F. James (United Kingdom Atomic Energy Authority. Reactor Group. Atomic Energy Establishment, Winfrith, Dorset, England). Apr. 1962. 11p.

Exploratory calculations are made of the reactivity change due to loss of Na coolant from a typical dilute fast reactor, with PuO_2-UO_2-steel cermet fuel. The calculations refer to a simple spherical reactor model, and multigroup diffusion theory is used. The primary object of the investigation is to compare the predictions of three commonly used sets of multigroup constants, derived from Lowenstein and Okrent (Argonne, 11 groups), Yiftah, Okrent and Moldauer (Argonne, 16 groups), and Hansen and Roach (Los Alamos, 16 groups). The results for the reactivity change obtained with these sets of constants are found to disagree in magnitude or sign. Analysis shows that resonance self-shielding in U^{238} and Pu^{239} below a few kev and capture in the 2.85 kev Na resonance have a large effect, but none of the sets allows for both phenomena. It is concluded that a necessary step toward the accurate prediction of Na reactivity coefficients in dilute fast reactors is the preparation of special multigroup constants below about 10 kev, which take account of both these resonance effects. (auth)

21712 (AEEW-R-96) HEAT DIFFUSION IN CYLINDRICAL FUEL ELEMENTS OF WATER COOLED REACTORS. J. Randles (United Kingdom Atomic Energy Authority. Reactor Group. Atomic Energy Establishment, Winfrith, Dorset, England). Sept. 1961. 30p.

A theoretical study is presented of heat diffusion in cylindrical fuel elements of water reactors. The steady state Fourier equation is solved considering appropriate temperature boundary conditions for flat and tilted fission power sources. It is shown that source tilting has no appreciable effect on peak full temperature and that the heat flux shows a circumferential variation in relation to the coolant of less than half that of the fission power. The theory is also extended to include the effect of a flat time-dependent fission power from which expressions are derived for fuel element transfer functions useful in servo-analysis. (J.R.D.)

21713 (AEEW-R-121) THE ROLE OF THE DYNAMIC MODEL IN NUCLEAR REACTOR CONTROL STUDIES. P. K. M'Pherson (United Kingdom Atomic Energy Authority. Reactor Group. Atomic Energy Establishment, Winfrith, Dorset, England). Sept. 1961. Revised, Nov. 1961. 48p.

Relations of dynamic models and methods of reactor control system synthesis are examined. The reliance of several control philosophies on such models is discussed and applications are suggested. A dynamic model of a simple linearized lumped parameter reactor is included to illustrate the method of the pole-zero approach and to show the significance of core feedback mechanisms in determining dynamic characteristics. (J.R.D.)

21714 (ANL-6440) THE ARGONNE THERMAL SOURCE REACTOR. Roland J. Armani (Argonne National Lab., Ill.). Mar. 1962. Contract W-31-109-eng-38. 39p.

The Argonne Thermal Source Reactor is a highly enriched, light-water-moderated thermal reactor. Movable shielding allows complete access to one face of the core. There is ready access to the central and 2 peripheral core locations, and it is possible to thrust samples with small reactivity effects into these locations. The reactor was approved for operation at 10 kw. Design and construction details are described to aid present and potential users of this facility. (auth)

21715 (BAW-154) MONTE CARLO CALCULATION OF NEUTRON ABSORPTION IN A SQUARE LATTICE. R. N. Kubik (Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.). Mar. 1961. 22p.

A code is presented which simulates neutron histories by following each of many particles from the thermal source through its life history. The elementary probabilities at each stage of the neutron's career are used to determine its fate until it is absorbed. The geometry is that of an infinite array of square cells which contain circular regions of fuel and cladding. The code is useful where P_3 calculations fail in cases such as tight lattices. (J.R.D.)

21716 (CVNA-114) REACTIVITY COEFFICIENTS AND NEUTRON SPECTRA IN A CLUSTERED, SLIGHTLY ENRICHED UO_2-D_2O TWO-REGION LATTICE. J. Jedruch and G. N. Hamilton (Westinghouse Electric Corp. Atomic Power Div., Pittsburgh). Mar. 1962. For Carolinas-Virginia Nuclear Power Associates, Inc., Charlotte, N. C. Contract [AT(30-1)-2289]. 174p.

A description is given of the facility used for the Carolinas Virginia Tube Reactor critical experiments. A full-size core mockup was used. Experimental techniques are given for measurement of void and temperature coefficients

of reactivity and results are compared with predictions. Kinetics and measurements associated with neutrons are included. (J.R.D.)

21717 (DP-682) CONTAMINATION AND DECONTAMINATION OF LOW TEMPERATURE, WATER-COOLED REACTORS. PART I. DISSOLVED RADIONUCLIDES ON STAINLESS AND MILD STEELS. Anton B. Carlson (Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Aiken, S. C.). Apr. 1962. Contract AT(07-2)-1. 45p.

The deposition from aqueous buffer systems of dissolved Co^{60}, Cr^{51}, Mn^{54}, Fe^{59}, $Ru^{106}-Rh^{106}$, and $Zr^{95}-Nb^{95}$ on stainless and mild steel surfaces was investigated at 25 to 60°C for exposure times up to eight days. This work, a part of a decontamination studies program, shows that the direct deposition of dissolved radionuclides on steel surfaces is not the predominant mechanism by which low temperature coolant systems become contaminated. (auth)

21718 (GEMP-72) REACTOR INSTRUMENTATION AND CONTROL PROGRESS REPORT NO. 72, MARCH 1, 1962–MAY 1, 1962. (General Electric Co. Flight Propulsion Lab. Dept., Cincinnati). May 31, 1962. Contract AT(40-1)-2847. 61p.

Progress is reported on reactor instrumentation and control programs. Topics covered include: circulating-ball reactivity control, static switching, capacitance temperature sensor, high-temperature extension of conventional nuclear sensors, development of nuclear sensors, high-temperature fasteners, fasteners for remote maintenance, and Monte Carlo shield and reactor analysis program. (M.C.G.)

21719 (IDO-16780) FUEL ELEMENT FLOW BLOCKAGE IN THE ENGINEERING TEST REACTOR. F. R. Keller. Appendices by: W. S. Little and J. H. Ronsick (Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho). May 10, 1962. Contract AT(10-1)-205. 48p.

On December 12, 1961, the Engineering Test Reactor experienced fuel fission breaks which resulted from obstructions to the flow of cooling water through several fuel elements. A total of six fuel elements had breaks in from one to eight fuel plates. A discussion and description of damage to the fuel is presented. The reactor operating conditions preceding the break are described, including events immediately before the manual scram. Results of investigations conducted after the scram, including effects upon the reactor as well as fuel element damage, are reported. (auth)

21720 (KAPL-M-PF-6) FLOW AND TEMPERATURE DISTRIBUTION IN A REACTOR FUEL MATRIX COOLED BY FREE CONVECTION TO PLENUM ABOVE. J. P. Fraser (Knolls Atomic Power Lab., Schenectady, N. Y.). Dec. 23, 1958. Contract W-31-109-eng-52. 27p.

A method is presented for calculating the free-convection flow pattern in a reactor fuel element matrix when element cooling is accomplished by free convection to an upper plenum. An application example is included. (J.R.D.)

21721 (MND-C-2500-2) APWRC-CELCOR, A FORTRAN-II PROGRAM FOR MULTIPLE LETHARGY LEVEL P1 OR DSN CELL CORRECTIONS IN CYLINDRICAL, SPHERICAL AND ONE- OR TWO-DIMENSIONAL SLAB GEOMETRY. T. M. Olsen, G. A. Cannon, E. A. Colbeth, D. H. Frederick, W. P. Kutz, and E. A. Schaefer (Martin Co. Nuclear Div., Baltimore). Mar. 1962. Contract AT(30-1)-2431. 209p.

A description of the nuclear analysis code, CELCOR, a FORTRAN-II program for the IBM 7090 computer is presented. CELCOR calculates multiple lethargy level cell corrections for spherical, cylindrical, or slab cells. For the slab case, a two-dimensional synthesis option is available, allowing consideration of the flux distribution, both perpendicular and parallel to the plane of the slab. Flux distributions may be calculated using P1 or SN options; S2, S4, S6, S8, and S16 approximations are available in all geometries except cylindrical, where storage requirements limited the highest order to S8. Comparisons are given of CELCOR analyses with experimental results. The latter include experimental fine activation distributions through a unit cell, heterogeneous-homogeneous fuel element substitution experiments, and assembly of clean critical configurations. A complete coverage of input and output, operating instructions, sample problem, equations and a program listing are included. (auth)

21722 (NAA-SR-6878) FUEL ROD BOWING IN THE SRE. H. F. Donohue and R. W. Keaten (Atomics International. Div. of North American Aviation, Inc., Canoga Park, Calif.). June 1, 1962. Contract AT-11-GEN-8. 23p.

A fast, positive power coefficient in the Sodium Reactor Experiment was attributed to thermal bowing of the fuel elements which was caused by temperature gradients across individual fuel rods. A similar reactivity effect, associated with a fast ramp change in coolant flow, was also observed during low-power physics tests, lending further credence to the bowing theory. To substantiate these hypotheses, an experimental assembly was fabricated to simulate fuel rod bowing under controlled conditions. A fuel element was modified so that the radial distance of the fuel rods from the vertical centerline of the fuel cluster was remotely adjustable. Measurements in the Sodium Graphite Reactor Critical Assembly resulted in a negative reactivity effect when the rods were bowed out, contrary to expectation. This was ascribed to the absence of Na around the fuel rods which caused a flat neutron flux gradient across the fuel channel. Outward bowing of the experimental cluster in the SRE resulted in a positive reactivity effect, as expected. Additional evidence of fuel rod bowing was obtained from hydraulic-loop studies which verified that increasing the flow velocity bowed the rods outward in the fuel channel. Previously it had been assumed that small changes in fuel position would cause negligible reactivity effects because of the long diffusion length of Sodium Graphite Reactors. These experiments proved that this was not true, and demonstrated that fuel rods must be constrained to prevent reactor instability. (auth)

21723 (NDA-2134-3) A FEASIBILITY STUDY OF FAST U^{233}-Th BREEDER REACTORS. (Nuclear Development Corp. of America, White Plains, N. Y.). Oct. 10, 1960. Contract AT(30-1)-2303(VIII).

A feasibility study of fast U^{233}-Th breeder reactors was performed. The feasibility of attainment of breeding ratios greater than one was clearly demonstrated for a family of reactors fueled by U-Th metal alloy rod-type fuel elements, cooled by sodium, and structurally built of stainless steel. Initial breeding ratios of 1.43 to 1.53 were established for infinite-blanket reactors over a wide range of core sizes and compositions. In a specific reference design with a finite blanket, the net breeding ratio was estimated at 1.33. The effects on breeding ratio of long term operation in an equilibrium fuel cycle were found to be negligible. Allowance for uncertainties in cross section data, particularly for U^{233}, was found in the most pessimistic case to reduce the breeding ratio from 1.33 to 1.15. The reference design, optimized to achieve a minimum doubling time, would require 25 yr of full-power operation to double the total system inventory of U^{233}; the initial core inventory would be doubled in about 5 yr. This 760 MW_{th} reactor, which would operate at an average specific power of 1.4 MW/kg U^{233}, is

governed by present-technology materials design limits. Addition of up to 20% beryllium as a moderating fuel diluent was found to cause a slight reduction in breeding ratio and increase in critical mass, but could provide design flexibility in achieving higher power densities and lower doubling times. Operational and safety aspects of the U^{233}-Th fast breeder were examined. The principal difference from other fast reactors arises as a consequence of protactinium-233 (Pa^{233}). The 27-day half life of Pa^{233}, the precursor of bred U^{233}, delays the availability of reactivity from new U^{233} and puts an unusual requirement on the control system at shutdown. Also examined were the fuel handling problem due to U^{232} buildup, and the Doppler temperature coefficient. Principal areas of further investigation that are discussed relate to improvement of doubling time and reduction of nuclear data uncertainties. (auth)

21724 (NP-11701) DESIGN CRITERIA FOR NUCLEAR REACTORS SAFETY SYSTEMS. S. Barabaschi and A. Mathis (Italy. Comitato Nazionale per l'Energia Nucleare. Laboratorio Ingegneria e Servomeccanismi Reattori, Ispra). Apr. 1962. 43p. (RT/ING(62)2).

Safety actions due to nuclear variables (neutron flux, period) are considered. The safety system connected with the period channels is studied, the criteria for the determination of the characteristic parameters are given with respect either to the response time or to the possibility of spurious actions. A comparison is made between the safety system related to the period and the one related to the flux level, and it is shown that the latter is much more effective than the former. (auth)

21725 (PWAC-139) HAZARDS SUMMARY REPORT ON NUCLEAR PHYSICS LABORATORY AT CANEL. (Pratt and Whitney Aircraft Div., United Aircraft Corp., Hartford, Conn.). [Oct. 13, 1955]. Contract [AT(11-1)-229]. 126p.

The critical experiment facility at CANEL is described. Information of the nature of experimental assemblies and operations is included. Safety features of the building, equipment, and operations are pointed out. Possible accidents and the resulting hazards to surrounding areas are analyzed. The make-up of the surrounding area is described. (M.C.G.)

21726 (TID-14844) CALCULATION OF DISTANCE FACTORS FOR POWER AND TEST REACTOR SITES. J. J. DiNunno, F. D. Anderson, R. E. Baker, and R. L. Waterfield (Division of Licensing and Regulation, AEC). [1962]. 41p.

Reference information and guidance on procedures and basic assumptions related to reactor siting are presented which can be used to calculate distance requirements consistent with current siting practices. A single method of computing distances and exposure for a general class of reactors is given. (J.R.D.)

21727 (TID-15473) DESIGN SUMMARY REPORT ON FUEL ASSEMBLY FLOW CONTROL. Report No. 306. Topical Report No. 2. James G. Bourne (Dynatech Corp., Cambridge, Mass.). Apr. 20, 1962. Contract AT(30-1)-2907. 37p.

Designs are presented for fuel assembly flow control systems which will place a predetermined design limit on the quality at exit from any fuel assembly in boiling water forced convection reactors. (J.R.D.)

21728 (XDC-60-1-211) CORRELATION OF MANY-ENERGY BARE REACTOR ANALYSIS (PROGRAM C-FINE) WITH CLEAN CRITICAL EXPERIMENTS INCLUDING BERYLLIUM–ORALLOY AND BERYLLIA–ORALLOY SYSTEMS. W. B. Henderson and E. W. Klingenberg (General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati). Jan. 25, 1960. Contract AT(11-1)-171. 49p.

The multiplication constants of a number of bare critical experiments were computed by the many-energy bare reactor analysis incorporated in Program C-Fine and are compared with standard 19-level slowing down calculations. The C-Fine results show better consistency than 19-level calculations. The consistent overprediction of multiplication constant, except in virtually 100% thermal reactors, may be rationalized by the high value of the average number of neutrons produced per fission employed in this work, as compared to recent, more accurate measurements. The reactor analysis incorporated in Program C-Fine computes the slowing down density, flux, and multiplication constant in a bare, homogeneous reactor, using sufficient energy detail that Breit-Wigner resonance cross sections are adequately portrayed by straight-line segments. The effect of spatial flux depression due to an inhomogeneous distribution of materials within a unit cell is treated by monoenergetic cell calculations. The beryllium (n,2n) reaction is treated by transfer cross sections. (auth)

21729 STATIONARY THERMAL STRESSES IN REACTOR PRESSURE VESSELS IN THE VICINITY OF THE COOLANT INLET. L. Boeswirth. Atomkernenergie, 7: 48-51(Feb. 1962). (In German)

By simplifying assumptions, the stationary temperature distribution and the thermoelastic stresses in the vicinity of the entrance of a subcooled cooling liquid into the pressure vessel are calculated. The derived formulas are evaluated numerically for a special case. (auth)

21730 THE FLUX DISTRIBUTION IN SUBCRITICAL PILES OF PLANE REGULAR SLAB GEOMETRY AND OF FINITE HEIGHT. M. Angelopoulos (Public Power Corp. of Greece, Athens). Atomkernenergie, 7: 81-92(Mar. 1962). (In German)

The flux distribution of thermal neutrons in a subcritical pile of regular slab geometry and of finite height was calculated, using the Galanin-Feinberg method. An extraneous linear source of fast neutrons is present in the pile. The problem is treated by using elementary diffusion theory for the thermal flux distribution in the moderator and Fermi age theory for the slowing down of fast neutrons. The solution of the boundary value problem is obtained by applying Fourier integral transforms. (auth)

21731 NONLINEAR STABILITY INVESTIGATION OF REACTORS AND REACTOR CONTROL SYSTEMS. R. Lauber (Technische Hochschule, Stuttgart). Atomkernenergie, 7: 95-101(Mar. 1962). (In German)

For nonlinear stability investigations of nuclear reactor systems, a generalized form of the describing function method is proposed, which allows the calculation of the stability limits and the drawing of general conclusions, whereas known analytical methods lead only to insufficient conditions. The describing function of the nuclear reactor is derived and used mainly to discuss the question of validity of linearizations. As an example, the method is applied to a boiling water reactor (EBWR), considering both linear and nonlinear feedback models. It is found that stability increases as the amplitude of perturbations increase. (auth)

21732 FAST NEUTRON REACTORS OVER THE WORLD. Melle M. Solanes and C. P. Zaleski (Commissariat à l'Énergie Atomique, Paris). Énergie nucléaire, 4: 85-101(Mar.-Apr. 1962). (In French)

Fast reactors should lead to very efficient use of all nuclear fuel stocks through the conversion of uranium-238 and thorium-232 into fissile materials. The use of plu-

tonium-240 produced in thermal reactors should also be possible. A review is given of accomplishments in this field, viz experimental reactors of zero or low power and nuclear plant prototypes. A description is given of component parts of fast power reactors, with particular reference to two American developments, the Experimental Breeder Reactor II (EBR-II) and the Enrico Fermi Fast Breeder Reactor (EFFBR). (auth)

21733 THE FINANCIAL ASPECTS OF NUCLEAR INSURANCE. René Gautron. Énergie nucléaire, 4: 102-8 (Mar.-Apr. 1962). (In French)

An insurance premium reduction would help to make energy of nuclear origin competitive with conventional power sources. An estimate is made of the place that insurance premiums hold in the working costs of an atomic power plant. The complex problems presented by nuclear insurance are reviewed, namely: difficulty in the evaluation of the entire amount of the premiums; problems concerning their distribution among the insurance pools; the establishment of reserves; and the payment of indemnities (e.g., uncertainty as to the frequency of the accidents to be covered, third party injuries, and damages caused at the installation). Various measures are proposed that could facilitate the solution of these problems. (auth)

21734 A METHOD OF MEASURING THE BURN-UP OF FUEL ELEMENTS IN NUCLEAR POWER REACTORS. L. Biondi. Energia nucleare (Milan), 9: 206-11(Apr. 1962). (In Italian)

A method for determining reactor fuel element burnup in power reactors, with the aim of deciding whether or not an element is to be sent to the reprocessing plant, is proposed and described. The experimental results obtained in different runs at the Sorin swimming pool reactor are given. (auth)

21735 STRENGTH OF THICK-WALLED PRESSURE VESSELS FOR MATERIALS WITH DIRECTIONAL PROPERTIES. A. E. Dapprich (Gannon Coll., Erie, Penna.), Joseph Marin, and Tu-lung Weng. J. Eng. Ind., 84: 197-204(May 1962).

A theory was developed for the determination of the plastic pressure-deformation relation in a thick-walled cylindrical pressure vessel subjected to internal pressure and made of an anisotropic material. In this theory, large or finite strains were considered and a closed solution was found for the pressure-strain relation based on a modified log-log tensile stress-strain relation. Theory was also developed for predicting the maximum pressure which the vessel can withstand. (auth)

21736 USE OF THORIUM IN BOILING WATER REACTORS. R. L. Crowther (General Electric Co., San Jose, Calif.). J. Nuclear Energy, Pts. A & B. Reactor Sci. and Technol., 16: 181-94(Apr. 1962).

The potential for use of Th^{232} as a fertile material in boiling reactors is reviewed. The use of ThO_2 for local power flattening in heterogeneous boiling reactors, and its application as fuel for the Dresden Nuclear Power Station is discussed. This method of flattening provides a number of advantages over simple enrichment variation. Supporting experimental measurements are reviewed. The nuclear aspects of U^{235}, Th^{232}, Pu–Th^{232}, and U^{235} mixed Th^{232}–U^{238} fuels are discussed for large BWR application. It is concluded that U^{235}–Th^{232} fuels are of interest because of the potential for achievement of long exposures. Mixed U^{238}–Th^{232} fertile isotopes provide possibly useful trends in resonance capture and conversion. From the nuclear standpoint plutonium is feasible as an initial or make-up fuel for a thorium cycle. The use of Th^{232} as compared to U^{238} is discussed. It is concluded that sufficient economic and technical information is not presently available to make a conclusive long-term choice between these fertile isotopes. (auth)

21737 A COOLING FACILITY FOR REACTOR IRRADIATIONS. F. A. Dugan, J. J. Floyd, F. P. Reeve, and A. N. Goland (Brookhaven National Lab., Upton, N. Y.). J. Nuclear Energy, Pts. A & B. Reactor Sci. and Technol., 16: 205-7(Apr. 1962). (BNL-5360)

The temperature of a sample subjected to irradiation in a nuclear reactor rises above the ambient temperature because of the absorption of gamma rays and neutrons. A water-cooled irradiation facility is described, which incorporates a vortex tube as a supplementary means of cooling. The temperatures of samples are reduced as much as 50°C through the use of the vortex tube. (auth)

21738 INFLUENCE OF XENON POISONING ON THE CONTROL AND SAFETY OF HIGH FLUX REACTORS. J. Furet and A. L. Garcia (Centre d'Études Nucléaires, Saclay, France). J. Nuclear Energy, Pts. A & B. Reactor Sci. and Technol., 16: 209-19(Apr. 1962). (In French)

The general laws governing the increase in xenon and iodine concentration in nuclear reactors employing thermal neutrons are given on the assumption that the neutron flux in the core is uniform. The mechanisms are shown by which the progressive xenon poisoning enables the imposition of certain rates of radioactive liberation on the control-rod insertion and withdrawal speeds. Since the progress in xenon poisoning depends on the past history of the reactor and since the search for the most rapid shut-down procedure is a question of finding an optimal solution, a certain number of parameters are evaluated that enable a definition of the shut-down procedure of high flux reactors to be stated, taking into account the progress in xenon concentration and the amount of available radioactivity. The results of the calculations are applied to high flux reactors of the type Siloë and Pegase. (auth)

21739 DETERMINATION OF THE STANDARD REACTIVITY AND MEASUREMENT OF THE EFFECTIVENESS OF DELAYED NEUTRONS IN "PROSERPINE." J. Bertrand, Ch. Clouet D'Orval, P. LeCoustey, C. LeLoup, and J. Tachon (Centre d'Études Nucléaires, Saclay, France). J. Nuclear Energy, Pts. A & B. Reactor Sci. and Technol., 16: 227-33(Apr. 1962). (In French)

In "Proserpine," a thermal reactor using plutonium, the geometry is small. It is thus interesting to measure the effective yield of delayed neutrons ($\beta_{eff} = \epsilon\beta_{Pu}$). The effectiveness ($\epsilon$) is greater than one, since delayed neutrons are born at a lower energy than prompt neutrons and since fast leakage is important. After having measured the absolute value of the reactivity, the curve $\rho = f(T)$ could be determined experimentally, where ρ = reactivity and T = period, and ϵ could be fit on the Nordheim relation. The result is $\epsilon = 1.1 \pm 0.05$ for all the delayed neutron groups. (auth)

21740 FLUX DENTING AS MEASUREMENT FOR THE EFFICIENCY OF AN ARBITRARY CONFIGURATION OF ABSORBER RODS IN A HOMOGENEOUS CYLINDRICAL REACTOR. [PART] II. H. Kiesewetter (VEB Entwicklung und Projektierung Kerntechnischer Anlagen, Berlin). Kernenergie, 5: 76-82(Feb. 1962). (In German)

In this second part of the report, the efficiency of an arbitrary rod configuration in a homogeneous cylindrical reactor is determined. (J.S.R.)

21741 XENON POISONING OF A REACTOR AND ITS REPRESENTATION ON A PHASE-PLANE. A. Roch (EPUL,

Laboratoire d'Électronique, Lausanne, Switzerland). Neue Tech., 4: 191-7(Apr. 1962). (In French)

The xenon poisoning of a nuclear reactor is represented on a phase-plane (iodine–xenon) with logarithmical scales. This solution gives easily a prediction for the poisoning and an optimum for the reactor control. (auth)

21742 NUCLEAR QUALITY STANDARDS AND SPECIFICATIONS. Warren J. McGonnagle (Argonne National Lab., Ill.). Nondestructive Testing, 20: 173-6; 181(May-June 1962).

Quality standards and specifications in nuclear industry are discussed. (M.C.G.)

21743 FAST/THERMAL KINETICS. Nuclear Eng., 7: 221-2(June 1962).

A comparison is given on the kinetic behavior of fast and thermal reactors. The comparison is centered around the understanding of net and total positive reactivity, time and magnitude concepts, neutron lifetime, temperature and energy, and integrated power. (N.W.R.)

21744 COMMENTS ON THE ROLE OF THE HAZARDS EVALUATION IN SITING AN EXPERIMENTAL HIGH FLUX REACTOR. Władysław Frankowski (Inst. of Nuclear Research, Polish Academy of Sciences, Warsaw). Nukleonika, 7: 89-93(1962). (In English)

The role of the hazards evaluation in siting a nuclear reactor is discussed in terms of general and exact siting. Attention is paid to the usefulness of the so-called index of risk in comparing particular alternatives of general siting. (auth)

21745 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. Richard Valentine Moore, Stanley Hackney, and Gordon Brown (to United Kingdom Atomic Energy Authority). British Patent 897,443. May 30, 1962.

A graphite-moderated gas-cooled reactor is designed so that access to the core through the containment vessel can be had for radioactive decay without waiting. The reactor has a composite radiation shield, comprising alternate layers of mild or boron steel plates and graphite blocks between the moderator structure and part of the containment vessel, and the shield has curved passages for passing coolant to the heat exchanger assembly above the shield. The lower end of the casing containing the core is closed by a similar shield pierced with a lattice of Y-branched fueling tubes. Thus, the two shields prevent the top and bottom of the containment vessel from being activated during reactor operation and allow personnel to perform necessary repairs. An alternate construction is also described in which fueling is done from the top. (D.L.C.)

21746 IMPROVEMENTS IN OR RELATING TO AN ASSEMBLY COMPRISING A HEAT SOURCE AND ASSOCIATED APPARATUS. Everett Long and William Rodwell (to United Kingdom Atomic Energy Authority). British Patent 897,445. May 30, 1962.

An assembly comprising a reactor connected to one or more heat exchangers is designed with supporting means which allows heat expansion or contraction of the reactor and/or heat exchangers. The supporting means comprises rollers or ball bearings disposed between pillars and spaced lugs attached to the reactor and heat exchangers, the plane of support being in the same plane as that of the axis of the connecting ducting which is of two-way coaxial construction. Embodiments of the invention are described for gas-cooled reactors. (D.L.C.)

21747 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. Everett Long and William Rodwell (to United Kingdom Atomic Energy Authority). British Patent 897,446. May 30, 1962.

A neutron shield is designed for use between the moderator structure and an access region of the pressure vessel in a gas-cooled graphite-moderated reactor. It has passages for coolant flow to the hot header and in each passage a shielding device which allows coolant to pass without substantial pressure drop across the device. The device comprises a rod provided with a plurality of helical fins and may be connected to the fuel elements lying below or to the biological shield plug above. (D.L.C.)

21748 IMPROVEMENTS IN OR RELATING TO REFUELLING MACHINES FOR GAS-COOLED NUCLEAR REACTORS. Everett Long and Herbert Chilvers Knights (to United Kingdom Atomic Energy Authority). British Patent 897,448. May 30, 1962.

A refueling machine for gas-cooled reactors is designed so that refueling can be done without shutdown or depressurization. The machine comprises a pressure vessel, a tubular coupling for insertion in an access tube, a sleeve surrounding the coupling and adapted for pressure-tight contact with the access tube, and an inlet for the circulation of pressurized coolant. (D.L.C.)

21749 IMPROVEMENTS IN OR RELATING TO REFUELLING MACHINES FOR NUCLEAR REACTORS. Everett Long, Herbert Chilvers Knights, and Peter Waine (to United Kingdom Atomic Energy Authority). British Patent 897,449. May 30, 1962.

A reactor refueling machine is provided with equipment for use in unusual or faulty conditions, in addition to normal refueling equipment. The emergency equipment includes a spare biological shield plug for sealing a reactor standpipe, a dump can for fuel element fragments, and a television camera; they may be brought into operative position by moving the refueling machine by a small amount. (D.L.C.)

21750 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. Herbert Chilvers Knights and Ernest Edward Jerkins (to United Kingdom Atomic Energy Authority). British Patent 897,450. May 30, 1962.

An appliance is designed for inclusion as part of a fuel element assembly for a gas-cooled reactor. The appliance has a biological shield plug at one end and an adjustable gag valve at the other end, and means is provided for adjusting the gag valve from the outer end of the shield plug to control the coolant flow to the hot box. (D.L.C.)

21751 IMPROVEMENTS IN OR RELATING TO ROTARY MOTION TRANSMISSION DRIVING MEANS. Gordon Packman (to United Kingdom Atomic Energy Authority). British Patent 897,451. May 30, 1962.

An apparatus for selective transmission of a drive to one of several rotary members is designed for use with a hoist in a reactor refueling machine. The apparatus comprises a movable carrier to bring one of the rotary members into register with a driving member, means for coupling the rotary member with the driving member, and means for preventing rotation of the other rotary members. (D.L.C.)

21752 IMPROVEMENTS IN OR RELATING TO REFUELLING MACHINES FOR NUCLEAR REACTORS. Everett Long (to United Kingdom Atomic Energy Authority). British Patent 897,452. May 30, 1962.

A reactor refueling machine is designed with part of the shielding removable for access to within the machine for manual operations. Interlocks and indicating means are provided for controlling and indicating the opening and closing movements. (D.L.C.)

21753 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTOR REFUELLING MACHINES. Herbert Chilvers Knights (to United Kingdom Atomic Energy Authority). British Patent 897,453. May 30, 1962.

A hoisting chain arrangement for raising irradiated fuel elements from a reactor is designed with leads for connection to thermocouple leads on the fuel elements for temperature indication. (D.L.C.)

21754 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTOR REFUELLING MACHINES. Everett Long, Gordon Packman, Herbert Chilvers Knights, and Ernest Edward Jerkins (to United Kingdom Atomic Energy Authority). British Patent 897,454. May 30, 1962.

A refueling machine for gas-cooled reactors is designed with a coolant circuit so that the reactor can be charged or discharged while under operation. The operation of the machine and its coolant circuit is described in detail. (D.L.C.)

21755 IMPROVEMENTS IN OR RELATING TO MEANS FOR SHUTTING DOWN NUCLEAR REACTORS. Shirley Russell Hopkins and Rex William Mallett (to United Kingdom Atomic Energy Authority). British Patent 897,455. May 30, 1962.

A shut-down device using neutron-absorbing ball shot for gas-cooled reactors is designed which can be actuated in response to a temperature rise in the core structure or to a drop in coolant pressure. A valve controlled by an electromagnet and a bellows is used to hold the balls above the core. (D.L.C.)

21756 IMPROVEMENTS IN OR RELATING TO THE SHUTTING DOWN OF NUCLEAR REACTORS. William Joseph Sidebottom and Leslie Maurice Fletcher (to United Kingdom Atomic Energy Authority). British Patent 897,456. May 30, 1962.

A shut-down device for gas-cooled reactors is designed with neutron-absorbing balls which are discharged into the core upon demagnetization of a valve. A sleeve is provided in the operative tube in the core so that, on discharge, the balls will fill the annular space between the tube and sleeve and hence fewer balls and less time are required to fill the tube. The tube can be withdrawn from the core for recovering the balls. (D.L.C.)

21757 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. Norman Bradley (to United Kingdom Atomic Energy Authority). British Patent 897,457. May 30, 1962.

A steam-cooled, heavy water-moderated reactor of the pressure tube type is designed with a thin baffle member in each pressure tube dividing the tube interior into an inner major coolant flow channel around the fuel elements and an outer annular channel with a minor fraction of the coolant flow. Water is injected into the annular channel to form a steam–water mixture which reduces heat transfer to the moderator and removes heat from the pressure tube. The reactor utilizes the multi-pass cooling system described in British Patent 897,447. (D.L.C.)

21758 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. Herbert Chilvers Knights and Ernest Edward Jerkins (to United Kingdom Atomic Energy Authority). British Patent 897,458. May 30, 1962.

A shield plug is designed for an access tube of a gas-cooled reactor. The plug has locking means for sealing the plug to the access tube and means for connection to a remote indicating position for providing information on the positions of parts of the locking means. A procedure is given for removing the plug from its access tube. (D.L.C.)

21759 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. Lucien Alfille and Jean Ropers (to Commissariat a l'Energie Atomique). British Patent 897,499. May 30, 1962.

A fuel cartridge is designed with a reinforcing member in the plug at one end of the sheath for reducing the creep of the plug during reactor operation. The reinforcing member, in the form of an annulus, collar, cap, or disc encircling the plug or sheath, is of a material which is more resistant to creep than the plug material. In this way, it is possible, with plugs of Mg or Mg alloys, to construct cartridge end structures capable of supporting charges of more than 100 kg at ≥500°C for 10,000 hr. (D.L.C.)

21760 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. Georges Lemesle and Pierre Rouge (to Commissariat a l'Energie Atomique). British Patent 897,534. May 30, 1962.

A graphite block moderator assembly is designed with means for sealing the cooling ducts to eliminate coolant leaks at the junctions between blocks. The means is a washer surrounding the coolant duct between two blocks and having either a circular or parallelepiped cross section. (D.L.C.)

21761 SAFETY-VALVE FOR CONTAMINATED GASES, FOR USE IN NUCLEAR REACTOR PLANTS. (to Brown, Boveri & Cie, A. G. and Beteiligungs-und Patentverwaltungsgesellschaft mit Beschränkter Haftung). British Patent 897,723. May 30, 1962.

A safety valve arrangement for passing radioactive gas coolant under excess pressure is designed with an absolute closing action. The arrangement has, between the safety valve and the contaminated gas space, an inlet space formed by a replaceable frangible disc supported on a grill so that it can withstand a high excess pressure in the inlet space directed toward the contaminated gas space but not a slight excess pressure in the contaminated gas space. A barrier gas is provided in the inlet space at a pressure just below that at which the safety valve operates but higher than the normal operating pressure in the contaminated gas space. (D.L.C.)

21762 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. Ian Alexander Butler Gaunt (to General Electric Co., Ltd.). British Patent 897,862. May 30, 1962.

A device for supporting the fuel elements in a channel and for restricting coolant flow therein in a reactor of the type described in British Patent 844,764 is designed with means for preventing faulty replacement which would cause overheating of the fuel elements. The device is a preassembled unit comprising a support body, an orifice plate, and catch means adapted to be supported on a seating at the base of the channel. The catch means comprises swinging levers with the arms adapted to engage upon the seating only when the orifice plate is the correct size or a larger one; if the orifice is too small, the lever arms are too long. (D.L.C.)

21763 METHOD AND APPARATUS FOR CONTROLLING THE REACTIVITY OF A NUCLEAR REACTOR. Andre Huet. British Patent 897,884. May 30, 1962.

A method for controlling the reactivity of a reactor by varying the distance between fuel rods is given in which pulsations in the coolant flow are used to effect the variation. The pulsations may be produced by a piezo-electric transducer and may comprise two or more different kinds of vibrations. (D.L.C.)

21764 IMPROVEMENTS IN OR RELATING TO A METHOD OF AND OPERATION FOR CONTROLLING A NUCLEAR REACTOR. Andre Huet. British Patent 897,889. May 30, 1962.

A reactor control system is designed which allows the pressure vessel to fit the reactor core closely rather than be large enough to enclose the control rods in their inoperative position. The system comprises tubes placed in apertures in the pressure vessel, and control may be effected by control rods lowered into the tubes or by a circulating fluid, in which latter case the tubes may be curved or convoluted. A header system for supplying fluid to the tubes is described. (D.L.C.)

21765 IMPROVEMENTS RELATING TO FUEL ELEMENTS FOR NUCLEAR REACTORS. Graham Coates and Frederick Wilde (to A.E.I.-John Thompson Nuclear Energy Co. Ltd.). British Patent 898,022. June 6, 1962.

A reactor fuel element is designed which can absorb fission gases given off from the fuel. The element comprises a plurality of fuel plates spaced apart for coolant flow between the plates, each of the plates comprising a Be-canned plurality of UO_2 slabs spaced apart to form cavities which are filled with porous MgO for absorbing fission gases. (D.L.C.)

21766 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. Jean Bellier and Andre Coyne (to Commissariat à l'Énergie Atomique). British Patent 898,052. June 6, 1962.

A prestressed concrete envelope is designed for use as both a radiation shield and a pressure vessel for pressurized atomic piles. The envelope comprises a body of concrete containing rectilinear metal cables both parallel and perpendicular to the axis of symmetry of the envelope. The cable ends are fixed by heads bearing against the external wall of the body. In the preferred embodiment, the envelope has its internal walls shaped into a cylinder and its external walls formed into a polygonal cross section with a number of parallel sides for the heads. (D.L.C.)

21767 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. Eric William Vickers Acton and Derek John Cresswell (to General Electric Co., Ltd.). British Patent 898,215. June 6, 1962.

Several fuel element assembly arrangements are described which give more efficient cooling of the elements. Each arrangement comprises 4 to 6 finned elements forming a cluster in the coolant passage. (D.L.C.)

21768 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. Gwillym John Blockley and George Oliver Jackson (to United Kingdom Atomic Energy Authority). British Patent 898,350. June 6, 1962.

A gas-cooled liquid-moderated reactor using re-entrant cooling is designed with increased space available for making individual gas connection with the core tubes outside the moderator tank. In this reactor, the thimble-ended core tubes are divided into two groups which enter the moderator tank in opposite directions so that they intermesh. (D.L.C.)

21769 IMPROVEMENTS IN OR RELATING TO MODERATOR CORE STRUCTURES FOR NUCLEAR REACTORS. Harry Albert Cox (to General Electric Co., Ltd.). British Patent 898,434. June 6, 1962.

A moderator core structure comprising an assembly of prismatic graphite blocks is designed for stabilization of the lattice spacing of the fuel channels in event of Wigner changes. The stabilization is obtained by means of tile members combined with corner keys and side face keys between the blocks. (D.L.C.)

21770 NUCLEAR REACTOR FUEL ELEMENT. (to U. S. Atomic Energy Commission). British Patent 898,712. June 14, 1962.

A plate-type fuel element for an organic-moderated reactor is designed in which heat transfer is improved and thermal stresses are minimized. The element comprises a plurality of fuel plates positioned within a shell, each plate having longitudinal serrations with periodic squared serrations contacting corresponding periodic serrations on adjacent plates. Fuel element dimensions are given for the OMRE. (D.L.C.)

21771 IMPROVEMENTS IN OR RELATING TO FUEL ELEMENTS FOR NUCLEAR REACTORS. Ivor Kent and Gordon Packman (to United Kingdom Atomic Energy Authority). British Patent 898,758. June 14, 1962.

A reactor fuel element is designed with a readily demountable coupling between two components so that, after irradiation in a reactor, the demounting can be effected by remote handling equipment. The fuel element comprises fuel members supported in a tubular housing by a tie rod, an extension of the housing movable axially, and a coupling between the extension and the tie rod. The coupling comprises a plurality of latch members within the extension and arranged to engage with the tie rod under load of the fuel members and housing. (D.L.C.)

21772 IMPROVEMENTS IN OR RELATING TO FUEL ELEMENTS FOR NUCLEAR REACTORS. Eric William Vickers Acton (to General Electric Co. Ltd.). British Patent 898,849. June 14, 1962.

A reactor fuel element with improved heat transfer is designed in which the number of welds required for a given quantity of fuel is considerably reduced. The fuel element comprises a coiled protective can filled with bodies of fissile material and mounted within a graphite sleeve in a reactor channel. Ceramic spacers are inserted between some of the fissile bodies to provide cool can areas for spider supports within the sleeve. Fins may be provided on the can. (D.L.C.)

21773 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. Anthony James Taylor (to Babcock & Wilcox Ltd.). British Patent 898,894. June 14, 1962.

A control system for gas-cooled graphite-moderated reactors is designed with means for driving the control rods to shutdown position and for holding them in shutdown position irrespective of subsequent failure of driving means or of reactor position. Each control rod is provided with a fluid pressure-actuated power device for driving the rod to its shutdown position and with locking means for holding the rod against the force of gravity in the shutdown position. The system is especially advantageous for mobile reactors, e.g., on ships. (D.L.C.)

21774 IMPROVEMENTS IN NUCLEAR REACTOR CHARGING ARRANGEMENTS. William Robert Wootton (to Babcock & Wilcox Ltd.). British Patent 898,895. June 14, 1962.

A reactor charging and discharging arrangement is designed for gas-cooled graphite-moderated reactors used in ship propulsion and having a control system of the type described in British Patent 898,894. In this arrangement, the position-determining element of a shutdown means is withdrawn from an articulated guide tube, and the guide tube is adjusted to serve as a charge and discharge chute. (D.L.C.)

21775 IMPROVEMENTS IN AND RELATING TO NUCLEAR REACTORS. William Macrae (to Nuclear Power Plant Co. Ltd.). British Patent 899,078. June 20, 1962.

A core structure comprising a plurality of graphite

blocks with coolant channels is designed so that misalignment of the channels due to irradiation is prevented even in the case of both growth and shrinkage. The structure has tabular spacers between adjacent pairs of blocks, the spacers being disposed in mutually perpendicular directions in horizontal planes. (D.L.C.)

21776 IMPROVEMENTS IN OR RELATING TO APPARATUS FOR DETECTING THE PRESENCE OF RADIOACTIVE PARTICLES IN A GAS STREAM. John Raymond Garner (to Plessey Co. Ltd.). British Patent 899,175. June 20, 1962.

A fuel element leak detector apparatus using an electrostatic precipitator is designed which is relatively compact and capable of operating under high pressure. The apparatus includes a precipitation chamber, means for feeding gas through the chamber, a detector, an endless wire extending through the chamber and detector on a pulley system, and means for moving the wire in steps from the chamber to the detector. (D.L.C.)

21777 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTOR FUEL ELEMENTS. Eric William Vickers Acton (to General Electric Co. Ltd.). British Patent 899,194. June 20, 1962.

A fuel element for gas-cooled reactors is designed with recesses for engaging with a grab for lifting and lowering the fuel element. The element comprises a finned, canned fuel rod supported within a graphite sleeve, and the inner surface of the sleeve is grooved to provide recesses for grab engagement. (D.L.C.)

21778 IMPROVEMENTS IN OR RELATING TO WELDED STRUCTURES. Geoffrey Herbert Haines (to General Electric Co. Ltd.). British Patent 899,224. June 20, 1962.

A welded structure is designed for a reactor pressure vessel to which one or more support skirts are welded along an annular zone. In this structure, the annular zone of the pressure vessel comprises a connecting ring with a plurality of flanges to which are welded the skirts and the two complementary portions of the vessel on each side of the annular zone. The bending stresses associated with hydraulic tests may be reduced by constructing the complementary portions of the vessel with different radii of curvature. An embodiment of the welded structure with a cruciform-shaped connecting ring is described for gas-cooled reactors. (D.L.C.)

21779 IMPROVEMENTS IN OR RELATING TO FUEL ELEMENTS FOR NUCLEAR REACTORS. William Selwyn Robson (to United Kingdom Atomic Energy Authority). British Patent 899,335. June 20, 1962.

A simplified splitter fin construction is designed for fitting on reactor fuel elements with helical heat transfer fins. The splitter fins are formed on a cylindrical member by extrusion thereof, and the cylindrical member is in part cut away between the fins to leave braces between the fins at intervals. The splitter fin body is then fitted onto a fuel element and held in place by means of slots and grooves in the heat transfer fins. (D.L.C.)

21780 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. Andre Huet. British Patent 899,410. June 20, 1962.

A reactor core is described whose fuel elements are arranged in a number of groups, each of which is disposed within an individual jacket. The jackets are in communication with adjacent jackets and are provided with interior tubes for supplementary fuel elements or control means. The advantages of such a reactor core are that the vessel can be constructed from several pipes and that the reactivity of the fuel element groups can be controlled individually. (D.L.C.)

21781 IMPROVEMENTS IN OR RELATING TO SUPPORT MEANS FOR PIPES OR DUCTS. Michael Hugh Ferrar (to General Electric Co., Ltd.). British Patent 899,728. June 27, 1962.

A support means is designed for supporting the main coolant pipes or ducts in gas-cooled reactors in such a manner that the turning moment produced by thermal expansion at the point of pipe attachment to the reactor vessel is automatically compensated. The support means includes a lever mechanism with a counterweight which is connected to the pipe in a manner to produce a force having two components, a constant vertical component for supporting the pipe weight and a variable horizontal component for balancing the turning moment. Several embodiments of the support means are described. (D.L.C.)

21782 IMPROVEMENTS IN THE PRECIPITATION OF DECAYED NUCLEAR FISSION PRODUCTS FROM GASES. Frank Harlen (to Dowty Electrics Ltd.). British Patent 899,745. June 27, 1962.

A combined precipitation and detector unit is designed for detecting fuel element failures in gas-cooled reactors. The unit has a simplified pulley system for moving the wire from the precipitation chamber to the detector. (D.L.C.)

21783 IMPROVEMENTS IN BURST JACKET DETECTION IN NUCLEAR REACTORS. Jean Goupil, Jean Megy, and Andre Roguin (to Commissariat à l'Énergie Atomique). British Patent 899,747. June 27, 1962.

A method and apparatus for detecting leaks in the jackets of jacketed fissionable bodies in a heterogeneous reactor are described which takes into account the coolant activity variations produced by power variations in the reactor. In the apparatus, the actual activity of each coolant stream leaving a reactor channel at any moment is compared with a reference activity corrected by a factor equal to the ratio of the actual power to the reference power. Two embodiments of the apparatus, one analog and the other digital, are described for a Marcoule-type reactor. (D.L.C.)

21784 PRESSURE CONTAINERS. (to Aktiebolaget Atomenergi). British Patent 899,851. June 27, 1962.

An arrangement for containers under gas pressure, e.g., gas-cooled reactors, is described which enables the container thickness to be reduced. In the arrangement, the container is arranged in a rock chamber with the space between the chamber wall and container filled with a liquid and with the container interior being in communication with the liquid-filled chamber. Thus, the container is subjected only to the pressure difference between the liquid levels in the chamber and the cover of the container. (D.L.C.)

21785 IMPROVEMENTS TO NUCLEAR REACTORS. Eric Victor Lockney (to Head Wrightson & Co. Ltd.). British Patent 899,867. June 27, 1962.

An adjustable device is designed for supporting fuel elements in a channel and for controlling coolant flow in a gas-cooled, graphite-moderated reactor. The device comprises a strut for supporting a fuel element, and a tabular strut body supporting the strut and extending below the reactor core support plate to provide a mounting for a valve element for coolant flow control. (D.L.C.)

21786 CLOSED-CYCLE WATER-BOILER REACTOR. Ivan F. Weeks (to North American Aviation, Inc.). U. S. Patent 3,028,327. Apr. 3, 1962.

The design and characteristics of a liquid homogeneous

reactor providing ultimate protection of the surrounding area against radioactive contamination are described. The reactor system is comprised of a water boiler reactor having a water solution of enriched uranyl nitrate for a core, hydrogen-oxygen recombiner system, nitrogen-oxygen recombiner system, sealed closed cycle gas recirculating system operating in an oxygen carrier medium and connected to accumulate and recirculate the gases generated in the solution through the hydrogen–oxygen recombiner and nitrogen–oxygen recombiner, and a system connected to the recirculating system for disposing of the gaseous fission products generated in the solution whereby the oxygen, hydrogen, and nitrogen formed by the decomposition of the uranyl nitrate solution are continuously recombined and returned to the solution by the closed cycle gas recirculating system. (N.W.R.)

21787 CONTROL METHOD AND APPARATUS. Wendell A. Horning (to Thompson Ramo Wooldridge, Inc.). U. S. Patent 3,036,964. May 29, 1962.

A control method and apparatus are described for operating a boiling water-moderated reactor at its designed capacity without power oscillations. The method comprises inserting filler members into the core during startup to decrease the moderator density and withdrawing the members after the operating level is reached. The filler members have the nuclear properties of steam and may be hollow aluminum containers filled with air. Thus, the reactor may be designed to operate at high power levels without resonance instabilities due to startup at high moderator density. (D.L.C.)

21788 STORAGE ARRANGEMENT. John D. McDaniels, Jr. (to Babcock & Wilcox Co.). U. S. Patent 3,037,120. May 29, 1962.

A storage arrangement is designed for liquid-shielded storage of radioactive components removed from a reactor. The arrangement comprises a storage pool, a cover having a plurality of interconnected slots, and a suspension means passing through the slots for suspending the radioactive components in the pool. Restrictive devices in certain slots are provided to prevent inadvertent criticality hazards. (D.L.C.)

21789 CONTROL ROD ACTUATOR MECHANISM. Clive M. Yeomans, Ralph E. Engberg, and Walter J. Taylor (to Martin-Marietta Corp.). U. S. Patent 3,038,846. June 12, 1962.

A control rod actuator mechanism is designed for pressurized water reactors. The mechanism uses the pressurized fluid from the reactor and gives gravity-operated scram operation when needed. (D.L.C.)

21790 REACTOR CONTROL. William J. Hartin (to Bendix Corp.). U. S. Patent 3,038,847. June 12, 1962.

A reactor control system based on the rate of increase of neutron generation is designed for bringing the reactor automatically to the desired power level in the minimum possible time consistent with safe conditions. In this control system, the rate of change of neutron generation of the reactor is subtracted from the demand level signal in proportion to the actual level of the demand signal. Thus, a control proportional to the power level is obtained, and changes at small power levels may be performed rapidly. (D.L.C.)

Power Reactors

21791 (AD-267442) A STUDY OF THERMOELECTRIC DIRECT-CONVERSION NUCLEAR REACTORS. Summary Report, November 1, 1960 to October 31, 1961. R. A. Chapman, W. R. Clendinning, R. B. Flanders, and M. A. Lynch (Texas Instruments, Inc. Central Research Labs., Dallas). Nov. 1961. Contract Nonr-3344(00). 173p.

For light-water moderated reactors using thermoelectric direct-conversion nuclear fuel elements, this study demonstrated that the reactor using PbTe can be made critical with less than 20% U^{235} enrichment; a prompt negative temperature coefficient of reactivity must be present in the fuel for safe operation; a cylindrical UO_2–PbTe element will withstand operating thermal stresses if properly designed; the element can be fabricated, but at considerable cost; the thermal power density must be considerably reduced upon introduction of the thermoelectric between the fuel and coolant; and the most promising thermal cycle is provided by natural circulation. These results do not rule out feasibility. At present efficiencies, however, the utility of this reactor concept must rest primarily on its ability to provide silent mobile power regardless of other performance characteristics. (auth)

21792 (AECL-1458) NUCLEAR POWER DEMONSTRATION. (Atomic Energy of Canada Ltd., Chalk River, Ont.). [nd]. 13p.

The Nuclear Power Demonstration facility at Chalk River is described. Photographs and diagrams are included. (J.R.D.)

21793 (AECL-1495) REGULATION AND PROTECTIVE SYSTEM DESIGN FOR NUCLEAR REACTORS. C. G. Lennox, A. Pearson, and P. R. Tunnicliffe (Atomic Energy of Canada Ltd., Chalk River, Ont.). Apr. 1962. 32p.

For presentation at the International Atomic Energy Agency Symposium on Reactor Safety and Hazards Evaluation Techniques, Vienna, May 14-18, 1962.

The behavior of the NRX and NRU regulating and protective systems was examined. The results covering a period of several years were used to draw conclusions about the performance of several aspects of the systems. The coincidence principle was useful in permitting the system to be kept in a reliable condition but the use of automatic intercomparison added little to the safety of the system. Faults common to all channels appear as the outstanding difficulty. It is also concluded that the performance of any system cannot be guaranteed without a period of modification and experience. The experience gained should be integrated with the new technology of digital computer control. An outline of a proposed system is described. (auth)

21794 (ANL-6565) REACTOR DEVELOPMENT PROGRAM PROGRESS REPORT, APRIL 1962. (Argonne National Lab., Ill.). May 15, 1962. Contract W-31-109-eng-38. 58p.

Research and development of water-cooled reactors are reported including work on EBWR and BORAX-V. Work on liquid metal cooled reactors is also reported in sections on general research and development, EBR-I and II, and FARET. Other work is reported on general nuclear technology and advanced systems development. (J.R.D.)

21795 (BAW-163) CONSOLIDATED EDISON THORIUM REACTOR. CORE ASSEMBLY PHYSICS AND ZERO POWER TESTS REPORT. M. C. Edlund, R. M. Ball, J. C. Deddens, and R. F. Flickinger (Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.). Sept. 1961. For Consolidated Edison Co. of New York, Inc. 49p.

Results of zero power tests to confirm the nuclear design of the Consolidated Edison Thorium Reactor Core are presented. The maximum core reactivity, control rod worths, and power distributions were measured. (M.C.G.)

21796 (DC-55-6-7) PROJECT 100 TASK REPORTS, [FOR] PERIOD ENDING JUNE 30, 1955. (General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati). June 1955. Contract [AT(11-1)-171]. 232p.

Information is presented on the progress and status of the HTRE reactor assembly, fuel elements, and control system. Individual progress reports are also included for each Project 100 task sub-section along with reports of individual contributions. (J.R.D.)

21797 (DLCS-1500103) CALIBRATION AND INTERCOMPARISON OF CONTROL RODS. CORE I, SEED 2. Test Results (T-550131). (Duquesne Light Co., Shippingport, Penna.). First issue, Jan. 13, 1961. Contract [AT(11-1)-292]. 31p.

An investigation was conducted to determine the reactivity symmetry of the core, the rod worths and critical heights for individual rods, and the core reactivity with any one rod stuck in its uppermost position. The reactor remained subcritical with any single rod stuck in its uppermost position except in the cases of rods 81, 82, and 83, however at the test conditions, criticality could not be established in these cases. (J.R.D.)

21798 (DLCS-1510108) DETERMINATION OF COEFFICIENTS OF REACTIVITY 5532.3 EFPH. CORE I, SEED 1. Test Results (T-550132). Section 1. (Duquesne Light Co., Shippingport, Penna.). First issue, Oct. 17, 1960. Contract [AT(11-1)-292]. 20p.

An investigation was conducted to determine the temperature and pressure coefficients of reactivity at zero power after 5532.3 EFPH of core I seed 1 operation. The value of the temperature coefficient at 500°F and 1800 psig was -0.97×10^{-4} $\Delta\rho/\Delta T$. The value of the pressure coefficient at 1350 to 1850 psig and 480°F was $+0.87 \times 10^{-6}$ $\Delta\rho/\Delta p$. (J.R.D.)

21799 (DLCS-1510109) MEASUREMENT OF COEFFICIENTS OF REACTIVITY. 0 EFPH. CORE I, SEED 2. (T-550132). Section 1. (Duquesne Light Co., Shippingport, Penna.). First issue, Sept. 22, 1960. Contract [AT(11-1)-292]. 48p.

An investigation was conducted to determine the temperature and pressure coefficients at zero power. It was found that the temperature and pressure coefficients of reactivity at zero power and at 500°F and 1785 psig were 2.20×10^{-4} $\Delta\rho/\Delta T$ and 2.50×10^{-6} $\Delta\rho/\Delta P$ respectively. (J.R.D.)

21800 (DLCS-151205) MEASUREMENT OF COEFFICIENTS OF REACTIVITY AT POWER. CORE I, SEED 2. Test Results (T-550132-A). Section 2. (Duquesne Light Co., Shippingport, Penna.). First issue, Jan. 10, 1961. 10p. Contract [AT(11-1)-292].

An investigation was conducted to determine the temperature coefficients of reactivity when the station is operating at power. Data and calculations are included. (J.R.D.)

21801 (DLCS-1740405) GOVERNOR PERFORMANCE TESTS. CORE I, SEED 2. Test Results. Section 4. (Duquesne Light Co., Shippingport, Penna.). First issue, Jan. 12, 1961. Contract [AT(11-1)-292]. 6p.

An investigation was conducted to determine the load at which each of the governor valves open when the primary average temperature is at 500°F. Data compilations for the test are presented along with comparisons with past performances. (J.R.D.)

21802 (DLCS-1800102) CHARGING AND DISCHARGING OF DEMINERALIZER RESINS. CORE I, SEED 2. Test Results (T-612085). Section 1. (Duquesne Light Co., Shippingport, Penna.). First issue, Jan. 10, 1961. Contract [AT(11-1)-292]. 7p.

An investigation was conducted to flush the 1BD coolant purification system demineralizer of resin and to measure the radiation level at points on the resin discharge line. It was found that the system demineralizer was satisfactorily flushed of resin. It was also found that the amount removed is measured by the amount required to recharge the demineralizer. (J.R.D.)

21803 (DLCS-1840402) PERIODIC RADIATION SURVEY OF REACTOR PLANT CONTAINER AND COMPONENTS AFTER SHUTDOWN "F" SURVEY. CORE I, SEED 1. Test Results (T-612076). Section 4. (Duquesne Light Co., Shippingport, Penna.). First issue, Oct. 17, 1960. Contract [AT(11-1)-292]. 8p.

An investigation was conducted to obtain measurements of radiation levels inside the hemispherical heads of the 1-B heat exchanger. The radiation levels were measured at the handholes on two occasions with an interval of 640 hrs between them. A very large increase was noted and could be explained only by the possibility that the measurement survey points were not identical. (J.R.D.)

21804 (DLCS-2130102) MODIFIED PURIFICATION SYSTEM PERFORMANCE TEST. CORE I, SEED 2. Test Results (T-641124). Section 1. (Duquesne Light Co., Shippingport, Penna.). First issue, Sept. 14, 1960. Contract [AT(11-1)-292]. 8p.

An investigation was conducted to establish an operating procedure for flushing water through a purification system demineralizer which was out of service for an extended period, and to determine the demineralizer serviceability. (J.R.D.)

21805 (DLCS-2390301) PERIODIC WASTE DISPOSAL SYSTEM MATERIAL BALANCE TEST. CORE I, SEED 1. Test Results (T-641317). Section 3. (Duquesne Light Co., Shippingport, Penna.). First issue, Oct. 17, 1960. Contract [AT(11-1)-292]. 10p.

An investigation was conducted to determine the adequacy of storage capacity and operating procedures of the waste disposal system during reactor cooldown for refueling. It was found that the waste storage capacity and the operating procedures were adequate. (J.R.D.)

21806 (DLCS-3170101) DETERMINATION OF RADIATION CONTAMINATION LEVELS DURING CORE I, SEED 1 REFUELING OPERATIONS. Test Result (T-641328). (Duquesne Light Co., Shippingport, Penna.). First issue, Feb. 3, 1961. Contract [AT(11-1)-292]. 56p.

A test was made to obtain a record of radiation contamination levels during core I seed 1 refueling operations. The recorded survey data indicated generally lower radiation levels than had been expected. (J.R.D.)

21807 (DLCS-3370103(Rev.)) PERIODIC CALIBRATION OF REACTOR PLANT FLOW INSTRUMENTATION. CORE I, SEED 3. Test Evaluation. (Duquesne Light Co., Shippingport, Penna.). First issue, Feb. 2, 1962. Second issue, May 1, 1962. Contract [AT(11-1)-292]. 53p.

A test was made to determine and correct calibration drifts in the PWR reactor plant coolant loop flow, purification loop flow, fill pump suction flow and FEDAL sample flow instrumentation. An effort was also made to scale the data acquisition system for coolant loop flows and purification loop flows. The calibration of all instrument trains was considered acceptable with the exception of the 1D reactor coolant loop flow which showed a large amount of hysteresis. (J.R.D.)

21808 (DLCS-3440103) RAPID STATION SHUTDOWN. CORE I, SEED 2. EFPH 1565.9. Test Results (T-643729). (Duquesne Light Co., Shippingport, Penna.). First issue, Apr. 6, 1961. Contract [AT(11-1)-292]. 14p.

An investigation was conducted to determine the dynamic response of the reactor plant to a rapid station shutdown and to prepare the station for low-power, Xe transient physics testing. The plant was satisfactorily shutdown and prepared for testing. (J.R.D.)

21809 (DLCS-3570105) REACTOR PLANT CONTAINER INTEGRITY TEST. CORE I, SEED 3. Test Evaluation. (Duquesne Light Co., Shippingport, Penna). First issue, May 7, 1962. Contract [AT(11-1)-292]. 9p.

An investigation was conducted to verify the integrity of the six reactor plant container airlocks by means of an air pressure test, visual inspection, and an operating check. Results indicate that monthly lubrication and the gasket popping system has almost eliminated leakage from this source. (J.R.D.)

21810 (DP-725) HEAVY WATER MODERATED POWER REACTORS. Progress Report, March 1962. R. R. Hood, comp. (Du Pont de Nemours (E. I.) & Co. Explosives Dept., Wilmington, Del.). Apr. 1962. Contract AT(07-2)-1. 53p.

The initial critical experiment was performed satisfactorily in the Heavy Water Components Test Reactor (HWCTR); low power physics tests are underway in the facility. Zr-clad tubes of U metal that were irradiated to moderate exposures in insulated capsules at high temperatures exhibited the relatively small core volume increase of approximately 5%. All the data on subcooled heat transfer burnout that were obtained at Savannah River Laboratory with water at pressures between 60 and 1200 psia are summarized, and correlating equations for these data are presented. The technological limits that are being used in the study for optimizing designs of natural-U-fueled, D_2O-cooled-and-moderated reactors are defined. Three preliminary reference designs of 300-Mwe power reactors were established within these technical limits. Work has also begun on the code modifications that will be required to incorporate organic-cooled reactors into this optimization study. (auth)

21811 (EURAEC-35) IMPROVEMENT OF HEAT TRANSFER IN BOILING WATER REACTORS. Quarterly Report No. 3, October–December 1960. (Société Nationale d'Étude et de Construction de Moteurs d'Aviation. Division Atomiques, Suresnes, France). Jan. 25, 1961. Work performed under United States–Euratom Joint Research and Development Program. Contract [017-60-4RDF]. 26p.

Laws relating to pressure losses and vacuum fractions were confirmed in two-phase flow investigations. Flow assemblies with 6 twisted strips in annular spaces were used to demonstrate the possibilities of obtaining 6 vortexes. Freon thermal tests revealed that with equal pumping power, a gain of 30 to 40% can be obtained on the calefaction flow. Results indicate that only large-pitch twisted strips are suitable for steam-water separation. (J.R.D.)

21812 (GNEC-230) NUCLEAR SUPERHEAT DEVELOPMENT PROGRAM ELEVENTH QUARTERLY PROGRESS REPORT, JANUARY–MARCH 1962. (Combustion Engineering, Inc., Windsor, Conn. and General Nuclear Engineering Corp., Dunedin, Fla.). Contract AT(11-1)-795. 68p.

Completion of the final reference design of NUSU using double-annular fuel elements is reported. Data from previously outlined critical experiments with annular multitude elements are presented along with data on azimuthal power peaking in fuel elements adjacent to large water gaps. Results of an investigation concerning the dependence of control effectiveness of flux-trap type rods on size, moderator content, and poison concentration are included. The NUSU fuel element (outer annulus of the double-annular fuel element), was satisfactorily operated for about two months and is being thermally cycled to confirm suspected leaks. Preliminary tests with both Hastelloy-X and Inconel as alternate superheat cladding materials appear satisfactory on visual and photographic examination. Additional examination with microphotographs is necessary. (J.R.D.)

21813 (HPR-21) DYNAMIC EXPERIMENTS WITH HBWR FIRST FUEL CHARGE. P. la Cour Christensen, A. Hellsten, and F. Åkerhielm (Norway. Institutt for Atomenergi. OECD Halden Reaktor Prosjekt). Apr. 1962. 70p.

A discussion is presented concerning results obtained from dynamic experiments with the first HBWR fuel charge. Descriptions of equipment and techniques applied during the experiments are also included. The measurements revealed that the reactor is very stable for all power and pressure levels. (J.R.D.)

21814 (KAPL-M-ECH-8) A CRITICAL EXAMINATION OF THE UNCERTAINTIES IN PREDICTED GROSS FISSION PRODUCT POISONING. E. C. Hansen (Knolls Atomic Power Lab., Schenectady, N. Y.). Mar. 8, 1962. Contract W-31-109-eng-52. 53p.

To predict correctly the lifetime of the highly enriched, pressurized water reactors, an accurate estimation of the gross fission product poisoning during and through core life is required. In addition, a knowledge of the uncertainty associated with the predicted gross poisoning is necessary. The sources of error in the predicted gross poisoning are listed. The detailed examination of errors introduced by the uncertainties in the experimental data upon which the calculations rest and by the assumption that the stable fission products are formed directly in fission is described. When the total thermal poisoning is expressed as a 2200 m/sec absorption cross section with the units barns/fission, its standard deviation is 3% essentially independent of fuel depletion, moderator temperature, and neutron flux spectrum. When the total resonance poisoning is expressed as a resonance integral with the units barns/fission, its standard deviation is 7% essentially independent of fuel depletion, moderator temperature, and neutron flux spectrum. The error introduced in the prediction of the gross fission product poisoning by the assumption that the stable fission products are formed directly in fission can be significant. However the lack of knowledge of the 2200 m/sec absorption cross sections and resonance integrals of the radioactive precursors and the necessity of specifying a power history prevents any statement being made quantifying the error introduced in any particular calculation. It can be concluded though that for any critical calculation of a lifetime of a specified system the gross fission product poisoning would have to be calculated properly accounting for the power history of the system and the holdup of the stable fission products during the time required for their radioactive precursors to decay. (auth)

21815 (NP-11706) THE ECONOMICS OF SMALL NUCLEAR POWER REACTORS, WITH SPECIAL REGARD TO THE NEEDS OF LESS-DEVELOPED COUNTRIES. Nuclear Reactors No. 5. (Shell International Petroleum Co. Ltd. Economics Div., London and Shell Internationale Research Maatschappij N. V. Nuclear Energy Div., The Hague). Feb. 1961. 24p.

An examination and comparison is presented concerning the economics of nuclear and conventional electricity generation in plants of less than 50 Mw. Special attention is directed to the needs of less-developed countries. (J.R.D.)

21816 (NYO-2482) A REVIEW OF YANKEE OPERATING DATA. (Nuclear Utility Services, Inc., Washington, D. C.). Nov. 1961. Contract AT(30-1)-2815. 257p. (NUS-107)

The information needs of various segments of industry for Yankee operating data and whether or not the information now available from Yankee is sufficient for these needs are discussed. The present availability of Yankee data is described. Recommendations to make present data more useful to industry and to provide more data are outlined. (M.C.G.)

21817 (TID-7630) NUCLEAR SUPERHEAT MEETING NO. 5, SEPTEMBER 13, 14, AND 15, 1961, SAN JOSE, CALIFORNIA. Andrew E. Mravca and Daniel E. Simpson (Chicago Operations Office, AEC). Dec. 18, 1961. 103p. (COO-264)

Minutes of the fifth AEC-sponsored nuclear superheat meetings are presented. Topics covered include: SADE loop experiment, out-of-pile corrosion experiments, SADE activity levels, heat transfer experiments, steam separator development, fuel technology, E-SADE program, NUSU critical experiments, BONUS critical experiments, engineering physics calculations, superheat fuel development, superheat critical experiments, BORAX-V superheat fuel elements, water chemistry program, in-core instrumentation development, UO_2 vibratory compaction development, status of nuclear superheat plants under design and construction, and nuclear superheat design studies. (M.C.G.)

21818 (TID-14978) COOLANT AND FUEL ELEMENT TECHNOLOGY FOR ORGANIC REACTORS. Status Report. (Division of Reactor Development, AEC). July 1, 1961. 151p.

A status summary on fouling and fuel element development is presented. Early history of organic coolant technology is cited along with plans for future development. The summary includes work at the University of Utah, California Research Corp., Phillips Petroleum Co., and Atomics International. (J.R.D.)

21819 (TID-15373) SUMMARY REPORT ON DEVELOPMENT OF FLAT PLATE CERAMIC FUEL ELEMENTS. This constitutes Technical Progress Report 26 under Contract AT(04-3)-249. J. J. Fargo (Gladding, McBean and Co., Los Angeles). Aug. 28, 1961. 32p.

A process is described for fabricating thin plates of urania by rolling a mixture of powder with organic binder, cutting to desired shape and sintering to densities of 95 to 97% of theoretical. Preliminary experiments are also described in which thoria–urania pieces were sintered to 95% of theoretical. (J.R.D.)

21820 (TID-15436) QUARTERLY PROGRESS REPORT ON EVALUATION OF AUTOMATIC FLOW BALANCING DEVICE IN BOILING WATER REACTORS, JANUARY–MARCH 1962. R. L. Mela, R. Moissis, J. G. Bourne, N. Radovcich, and E. D. Doyle (Dynatech Corp., Cambridge, Mass.). Apr. 11, 1962. Contract AT(30-1)-2907. 26p.

Typical operating conditions for boiling water reactors were established and two alternate fuel assembly flow control systems were analyzed to the point of definitive equations. Literature surveys on two-phase flow through vertical venturis are reported along with original work on two-phase flow regimes. Description of experimental apparatus and planned experimental schedule are also included. (J.R.D.)

21821 (TID-15502) [PWR] MONTHLY OPERATING REPORT, MARCH 1962. Vol. V–Issue 3. (Duquesne Light Co., Shippingport, Penna.). Contract AT(11-1)-292. 56p.

Details of a scheduled shutdown are given including low power physics tests. It is noted that there were five incidents during the period, only one of which resulted in a safety shutdown. Chemical conditions and contamination levels in most areas were maintained at specified references during the period. Other details are given concerning tests performed and the power station training program. (J.R.D.)

21822 (UCRL-6305) TORY II-A MECHANICAL AND AERO-THERMODYNAMIC DESIGN. J. W. Cox and P. M. Uthe (California. Univ., Livermore. Lawrence Radiation Lab.). Feb. 2, 1962. Contract W-7405-Eng-48. 52p.

Presented at Institute of Aero-Space Sciences Annual Meeting, New York, January 22, 1962.

The first nuclear reactor in the Pluto program, Tory II-A, is described from the standpoint of mechanical and aero-thermodynamic design. Experimental objectives and predicted aero-thermodynamic performance are presented. A discussion of mechanical design includes principal structural features, material selection, and a review of component design and testing. Digital computing machine codes used to study transient and steady-state aero-thermodynamic performance are described, together with the correlation functions employed. Both experimental and analytical methods are outlined for evaluating thermal stress in fuel elements and structural members. (auth)

21823 (WAPD-PWR-TE-70) DL-S-185 (T-641105), FAILED ELEMENT DETECTION AND LOCATION SYSTEM (OPERATIONAL) TEST. P. W. Frank (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). Nov. 1960. Revised, Apr. 1962. Contract AT-11-1-GEN-14. 11p.

An investigation was conducted to determine the background delayed neutron activities in the effluent from each PWR blanket assembly and to determine the statistical distribution of these activities. Data from a series of tests indicate that the log-normal appears to be the most representative of the statistical distribution. The average activities appear to have increased in the series but the ratio of the individual activities to the mean remained the same throughout seed 1 life. (J.R.D.)

21824 (WAPD-PWR-TE-89) REACTOR COOLANT RADIONUCLIDE BASE LEVELS PWR CORE 1 SEED 2. DLCS 3540101. W. Lechnick (Westinghouse Electric Corp. Bettis Atomic Power Lab., Pittsburgh). Feb. 1962. Contract AT(11-1)-GEN-14. 7p.

Fission product levels of the primary coolant at PWR decreased between end of Core 1 Seed 1 life and early Core 1 Seed 2 operations. This decrease was probably the result of removing the old seed with its associated Pu^{239}. The replacement seed had a relatively low U contamination level, however, absolute contamination values of the replacement seed could not be determined because of background activity from the blanket fuel. (auth)

21825 (WCAP-4121) CAROLINAS VIRGINIA NUCLEAR POWER ASSOCIATES, INC., CVTR PROJECT MONTHLY PROGRESS REPORT, JANUARY 1962. (Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh). Contract AT(30-1)-2289. 16p.

Progress is reported on project administration, nuclear design, pressure tube assembly and analysis, fuel development, irradiation experiments and analysis, component development, plant system development, instrumentation and control, safety analysis and evaluation, and critical experiments. (M.C.G.)

21826 THE GAS-COOLED HIGH TEMPERATURE REACTOR FOR SHIP PROPULSION. F. de Hoffmann

(General Atomic Div., General Dynamics Corp., San Diego, Calif.). Atomkernenergie, 7: 41-7(Feb. 1962). (In German)

General Atomic has been developing a gas-cooled reactor system jointly for the USAEC and US Maritime Commission. Gas cooling, in a closed cycle at high pressure, permits high-temperature operation and consequently high thermal efficiency. Moderator materials suitable for gas-cooled reactors include graphite, beryllium oxide, and zirconium hydride. Graphite-moderated reactors are best adapted to the very large power ranges. Beryllium oxide seems appropriate in the range of 20 to 75 Mw electrical and zirconium hydride seems appropriate in the range below 30 Mw down to about 7.5 Mw electrical. The most promising coolants for gas-cooled reactors are helium and carbon dioxide. Helium is most appropriate in large power reactors where adequate volume in the reactor is available for coolant, and where the gas flow rate is high enough for efficient compression by axial compressors. Carbon dioxide is better adapted to smaller systems, where it eases the problems of gas compression at low flow rates and heat transport from physically small cores. The General Atomic ship reactor project, which is directed at a power level of 30,000 SHP (or 22.5 Mw electrical), uses beryllium oxide as moderator and helium as coolant. Fuel elements, control drives and moderator structures were developed and tested, and an experimental reactor (EBOR) located in Idaho will provide a full environment test. In addition the turbomachinery for a closed cycle plant using the reactor as heat source was designed and components were tested. This reactor system also has promise in a central station power plant for an intermediate power level. Further improvement in the economic promise of this system can be expected as better high temperature construction materials become available. General Atomic has also studied a reactor system for smaller power output (22,000 SHP or 16 Mw electrical), using zirconium hydride as moderator and carbon dioxide as coolant. However, experimental and design work on this system are not as far along as on the BeO system. Much of the information gained in the TRIGA reactor project is applicable to this system. Development of canning techniques will permit the use of higher hydrides of zirconium, up to $ZrH_{1.8}$, which do not suffer the low temperature phase change during thermal cycling. This system appears interesting for power levels up to 40,000 SHP. (auth)

21827 POWER DENSITY OF COMPACT REACTORS. H. N. Schludi. Atomkernenergie, 7: 102-5(Mar. 1962). (In German)

Whenever in the reactor layout, in addition to the basic concepts about reactor dimensions, moderator, reflector, and coolant, the fuel element is given too, the coolant temperature rise and the multiplication factor are fixed. In compact reactors, where the leakage of thermal neutrons is negligibly small, for these assumptions the power density of the reactor can be calculated directly without a trial and error method. The example of the sodium-cooled beryllium oxide reactor shows that the power-density also depends on the reactor dimensions and has a maximum. (auth)

21828 METHODOLOGY OF COST CALCULATION IN NUCLEAR POWER STATIONS. [PART] IV. Walter Baur (Fortsetzung und Schluss, Heidelberg). Atomwirtschaft, 7: 206-8(Apr. 1962). (In German)

A general cost equation for all reactor types was worked out which makes possible an exact calculation of energy costs and, further, provides a basis for operational arrangements in nuclear power stations. It takes into equal consideration economic, technical, and nuclear-physical points of view since only a total study of a projected reactor construction and of possible technical and costwise improvements during operation gives a picture of the profitableness of the installation. The individual terms of the cost equation are dealt with in detail. The fixed costs consist of capital costs, operating costs, and material costs of an investment nature. According to the cost theory, running expenditure which is dependent upon the production of the plant is to be regarded as a variable cost. In this category belong fuel costs, costs of the cooling means, and other costs dependent upon working. (auth)

21829 POSSIBILITIES FOR THE UTILIZATION OF ALUMINUM CONSTRUCTION MATERIALS IN WATER-COOLED POWER REACTORS (SUMMARY REPORT). H. Spindler (Zentralinstitut für Kernphysik, Rossendorf, Ger.). Kernenergie, 5: 67-75(Feb. 1962). (In German)

After a discussion of the reasons for the interest in Al construction materials as cladding materials in water-cooled power reactors, the studies made in the last few years on the improvement of the corrosion and thermal stabilities are reported and the results obtained are described. Corrosion in still and running water, alloying developments, the effects of the inhibitors, heat transitions, and reactor radiation, and the possibilities for the improvement of these properties of stability by preparation of Al sinter materials are discussed. An evaluation of this material with respect to its introduction in high-temperature water-cooled power reactors is given. (tr-auth)

21830 THE OECD HALDEN REACTOR PROJECT. J. P. Buclin (ETH, OECD Halden Reactor Project and Société Générale pour l'Industire, Geneva). Neue Tech., 4: 175-86(Apr. 1962). (In English)

The state of the progress at the Halden Heavy Water Boiling Reactor Project at the end of October, 1961, is described. A summary of the research program scheduled for the future is provided. A list of the most important design characteristics of the reactor complex is given. The main part of the work deals with a simplified presentation of the results obtained from experiments with the first, metallic fuel charge (5 MW_{th}), terminated in May, 1961, together with a description of the methods applied for the measurements. Extensive modifications are now under way, in order to increase the power output of the reactor to 20 Mw_{th}. Then, the objectives of a more comprehensive research program with the second fuel charge are presented. Some information is given on the internal organization of the Project, on the participation from Switzerland, and on future prospects for the continuation of the Halden Project. (auth)

21831 A BRIGHT FUTURE FOR FAST REACTORS. Roy Herbert. New Scientist, 14: 336-8(May 17, 1962).

The Dounreay fast breeder reactor is now demonstrating that large safe reactors using enriched fuel can be built for producing economical power. Operating experience with this reactor is described along with the many problems that were overcome. (N.W.R.)

21832 NPD-2, CANADA'S PROTOTYPE POWER REACTOR. A. Wyatt. Nuclear Energy, 192-201(May 1962).

The Nuclear Power Demonstration (NPD), the Canadian prototype power reactor, is described. The description includes information on total and individual costs, 17-Mw electrical output reactor, turbine-generator plant, calandria, coolant tube assemblies, fueling, refueling cycle, primary

heat transport system, moderator and helium systems, reflector system, heavy water purification, control systems, manpower, and general specifications. (N.W.R.)

21833 A MODERN APPROACH TO NUCLEAR ENGINEERING DESIGN. J. G. Bryan. Nuclear Energy, 206-16 (May 1962).

A new technique of finding the optimum combination of a large number of variables is described. It relies on the use of a modern electronic computer and was developed for the design of nuclear power stations. It is capable of wide application and its impact on the organization of a complex project is shown by discussing the steps in the design of a complete nuclear power station from the inquiry stage to that of detailed specification. (auth)

21834 NUCLEAR REACTOR POWER PLANTS. (to Sulzer Frères, Société Anonyme). British Patent 897,416. May 30, 1962.

A nuclear power plant is designed in which the working medium is pressurized in the liquid state, converted to vapor in an evaporator outside the reactor, passed through the reactor in a plurality of consecutive passes, and passed on to the turbine system. The working medium is cooled between passes through the reactor by heat exchange in the evaporator. One advantage of this power plant is that only one pump is required for the entire coolant system. (D.L.C.)

21835 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTOR SYSTEMS FOR PRODUCING A SUPERHEATED WORKING FLUID. Norman Bradley (to United Kingdom Atomic Energy Authority). British Patent 897,447. May 30, 1962.

A heavy water-moderated steam-cooled reactor is designed for production of superheated steam without mechanical pumping in the vapor state. In this reactor, water is converted into saturated vapor in evaporators and then into superheated steam in the reactor zone, and some of the superheated steam is used to produce mechanical energy in a turbine while the rest is used in the evaporators to produce saturated vapor from water. A feed heater is provided to stabilize the reactor. (D.L.C.)

21836 IMPROVEMENTS IN OR RELATING TO NUCLEAR REACTORS. (to Commissariat a l'Energie Atomique). British Patent 897,483. May 30, 1962.

A boiling reactor is designed with a heat-absorbing device to come into action in case of emergency reactor stoppage or excess pressure in the primary circuit. The device comprises a group of tubes in a biological shield tank of water through which water is passed. The reactor is especially suited for driving a ship. (D.L.C.)

21837 PROCESS FOR REGULATING THE FUNCTION OF A NUCLEAR REACTOR AND INSTALLATION FOR CARRYING IT INTO EFFECT. (to Ste Ame Cockerill-Ougree). British Patent 898,332. June 6, 1962.

A process for regulating a reactor is given for the cases where the primary coolant (gas or liquid) extracts the heat and is passed into a heat exchanger for generating steam, and where water is vaporized in the reactor itself. The regulation is effected by automatic variation of the circulation of the primary coolant to the reactor so that it is proportional to the steam output. The circulation variation is obtained with equipment driven by low-expansion steam turbines. An advantage of the process is that equipment for coolant circulation can be made very simple and inexpensive. (D.L.C.)

21838 NUCLEAR REACTOR PLANT FOR POWER GENERATION. Wolfgang Brauen (to Siemens-Schuckertwerke Aktiengesellschaft). U. S. Patent 3,036,965. May 29, 1962.

A boiling reactor moderated and cooled by D_2O is designed so that it has the advantages of pressurized reactors without the disadvantages of boiling or pressurized reactors. The reactor vessel is provided with two pressure zones, a boiling zone and a reaction zone kept at a higher pressure. The two zones are in communication with each other through nozzles in the flow channels. (D.L.C.)

Research Reactors

21839 (IDO-16760) MATERIALS TESTING REACTOR-ENGINEERING TEST REACTOR TECHNICAL BRANCHES QUARTERLY REPORT, OCTOBER 1–DECEMBER 31, 1961. (Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho). Mar. 20, 1962. Contract AT(10-1)-205. 55p.

Two-dimensional poison and fuel weighting functions were calculated for the ARMF which agree well with experimental measurements. Reactor physics calculations were made in cylindrical systems consisting of boron-stainless-steel flat plates distributed in homogeneous solutions of $UO_2(NO_3)_2$ to compare with critical experiments. Some progress was made in developing calculational methods which can be used with some reliance in the evaluation of possible criticality hazards and in design studies for the ICPP. New MUFT R beryllium decks were developed from basic nuclear data. The use of these decks in MUFT R calculations brought the calculated age more in line with experimental values. The presence of thorium was shown to increase F_1, the factor that characterizes the 1/E component of the neutron flux, by 60 to 80% in the ARMF. Wires consisting of 1% gold and 99% copper were used as monitors in this measurement. The study of liquid phase sorption of boric acid on three aluminas indicated appreciable sorption on two activated aluminas, and negligible sorption on a hydrated alpha alumina. The sorption was determined at slightly above room temperature. Sample fuel plates of uranium-aluminum alloys and uranium oxide-aluminum cermets were irradiated at 400°F in the MTR core and post-irradiation annealing tests were conducted at 390 to 650°F. Irradiation of 13 UO_2 Experimental Gas Cooled Reactor fuel capsules in the ETR continued. Total cross section measurements of Pu^{238} were made in the energy region from 0.01 to 20 ev. Resonances were obtained at 2.88, 5.17, 9.96, and 18.6 ev. A survey measurement was taken utilizing the 45-meter flight path, and additional resonances were observed at ~60, 70, and 83 ev. A total thermal cross section of ~610 barns was measured. A preliminary resonance activation integral value of 8.4 barns and a thermal activation cross section of 1.0 barn was obtained for Nb^{94} activating to 2.03×10^4-year Nb^{94}. A resonance integral of 500 barns and a thermal activation cross section of ~5 barns was determined for 2.03×10^4-year Nb^{94} activating to 35.3-day Nb^{95}. A corrected value for the half life of Sb^{122m} was established as 4.2 min. This was reported previously as 3.5 min for the metastable state. Measurements were made to determine changes in the symmetric/asymmetric fission ratio of U^{235} near 0.284-ev resonance. In conjunction with the decay schemes program, computer techniques were developed which permit the calculation of the complete pulse-height response of a scintillation spectrometer to any radioactive nuclide. This requires only a knowledge of the decay scheme and the measurement parameters for the detector being used. Special techniques were developed in several areas of instrumentation. A constant charge pulse generator allows

charge supplied to a capacitor to be constant to 0.1 percent. A line surge protector will completely disconnect transistor equipment from the line 2 milliseconds after the surge first appears. A fast-scaling 1-microsecond double pulse resolution scaler with 6 decades of electrical and meter readout uses solid state circuit components and can be built for $750. An arrangement of a neutron source, a BF_3 chamber, and appropriate electronics allowed continuous determination of boron concentration in a boric acid chemical loop. A 3-phase oscillator to be used in operation of the velocity selector rotors has a frequency choice from 166 to 500 cps with a short term stability (jitter) less than 1 microsecond. A group of new IBM-650 programs was completed and placed in service: a general purpose nonlinear least squares fitting program, a program to compute the shape of beta-ray energy distributions, an orbital electron tracing program, an auto-correlation and power spectrum program, and a program to process data from the PAED-24 experiment in the MTR. Work has started on a program for the quantitative analysis of gamma-ray spectra by the method of least squares. In addition an IBM 650 library program for critical path scheduling was recoded to increase its scope and flexibility. The revisions of the IBM 650 one-dimensional diffusion theory code, DMM, were completed, and the revised code placed in general use. (auth)

21840 THE SIEMENS TRAINING REACTOR SUR. G. Hildenbrand, P. Hoehne, and E. Schwarz (Siemens-Schuckertwerke A. G., Erlangen, Ger.). Atomwirtschaft, 7: 209-14(Apr. 1962). (In German)

In order to meet the requirements of a reasonable purchase price and low running costs necessary to bring a reactor into normal laboratories, Siemens developed a zero energy reactor which can be operated up to a thermal output of 1 W. The neutron flux at a reactor loading of 0.1 W amounts, in the central experimental channel, to $5 \cdot 10^8$ n/cm^2-sec. With this output the reactor is intended for education and training purposes, for which a higher capacity is less important. For measuring purposes and as a source of radiation the reactor is operated at a loading of 1 W and $5 \cdot 10^7$ n/cm^2-sec, the shielding round the outer reactor vessel then being reinforced. The reactor core consists of individual plates of a pressed homogeneous mixture of U_3O_8 powder as fuel and polyethylene as moderator with 20% U^{235} enrichment. The critical quantity of fuel is about 700 g U^{235}. The reactor core is surrounded on all sides by a graphite reflector 20-cm thick. As shielding there is 10 cm of lead and a 60-cm thick water jacket. Even at the surface of the outer reactor vessel the radiation dose rate, at a reactor power of 0.1 W, is less than the permissible tolerance limit of 2.5 mrem/hr. The experimental facilities of the SUR consist of three horizontal test channels and a thermal column of graphite. Two vertical experimental channels pass through it, one on the cylindrical axis of the reactor and the other parallel to it in the outer region of the thermal column. The SUR has two completely independent safety systems either of which alone is capable of safely shutting down the reactor. In addition, solely because of the composition of the core, it possesses an inner safety which, already at the low excess reactivity of 0.3%, ensures that an extremely improbable output excursion is automatically halted. All the reactor instrumentation is installed in one control desk at which the operator has all controls within reach and all the indicating instruments within his field of view and from which he can completely control the reactor. The running costs are very low since the fuel consumption is only about 30 μg of U^{235} per year and the power requirements amount to only about 4.5 kW. The SUR finds its most important application as a practical tool for education and training in the field of nuclear technology. Beyond this the reactor has application possibilities in the fields of measurement technology, nuclear medicine, nuclear biology and nuclear chemistry by using it for the activation of short-lived isotopes and as a neutron source. These possibilities are considered in detail. (auth)

21841 THE EXPERIMENTAL ORGANIC LOOP IN THE IRT-2000 REACTOR OF THE WHITE RUSSIAN ACADEMY OF SCIENCES. V. S. Ermakov and V. A. Sokol'chik. Inzhener.-Fiz. Zhur., Akad. Nauk Belorus. S.S.R., 4: No. 12, 109-17(Dec. 1961). (In Russian)

A loop to be used for studying the heat transfer properties of organic liquids will be installed in the IRT-2000 reactor which is currently under construction at the Institute of Energetics of the White Russian Academy of Sciences in Minsk. While the organic liquids present many advantages as reactor coolants, their resistance against heat and ionizing radiation must be evaluated under actual reactor conditions. The following general program will be carried out with the new facility: (1) study of the decomposition rate of the various coolants as a function of the temperature and the total absorbed energy; (2) investigation of the heat transfer characteristics of the fuel element–coolant systems and of the effect of high-boiling residues on the heat transfer coefficient; (3) study of various fuel element design concepts; (4) examination of the corrosive behavior of organic liquids in contact with various structural materials; (5) determination of the effect of the loop on the operation of the reactor, in particular, on the multiplication factor; (6) testing of mechanical fittings and of instruments; and (7) study of biological shielding problems. Monoisopropyl diphenyl will be tested first. The thermal rating of the loop is 150 kw, flow rate of the coolant 25 m^3/hr, and its exit temperature 400°. (TTT)

21842 CRITICAL EXPERIMENT WITH GRAPHITE REFLECTOR IN THE VVRS "EWA" REACTOR. M. Czerniewski and P. Szulc (Inst. of Nuclear Research, Polish Academy of Sciences, [Warsaw]). Nukleonika, 7: 81-8(1962). (In Russian)

Experimental data concerning critical mass, control-rod worths, and reactivity effects of a fuel assembly and graphite expellers were obtained. (auth)

21843 LOW POWER NUCLEAR REACTORS. Arthur Trew Biehl (to Aerojet-General Nucleonics). British Patent 897,421. May 30, 1962.

A fail-safe low-power self-contained reactor is designed for use in education, research, etc. The fuel is in the form of discs of hydrogenous polymer with dispersed UO_2 particles, and the core comprising a plurality of such discs is arranged with fuse and spring means for separating the discs to stop the reaction in event of excursion. The polymer of the fuel discs preferably is crosslinked polyethylene, while the fuse preferably is polystyrene with a U loading twice that of the fuel discs. U-loaded safety and control rods are also provided with similar fuse and spring means for removal from the core in event of excursion. Other ways of making the reactor subcritical are described. (D.L.C.)

SPACE APPLICATIONS AND TECHNOLOGY

Refer also to abstracts 20236, 20237, and 20301.

21844 (AD-263476) PRINCIPLES FOR THE CALCULATION OF RADIATION DOSE RATES IN SPACE VEHICLES. Report No. 63270-05-01. Robley D. Evans (Massachusetts Inst. of Tech., Cambridge). July 1961. Contract NAS 5-664. 90p.

An analysis is presented which takes into account the angular distribution of the incident protons and electrons and the angular distribution of the electron bremsstrahlung. The distribution with depth in the propellant is determined for the dose rate due to protons, for the dose rate due to electron bremsstrahlung, and for the deposition of stopped protons. Whereas the dose rates for monoenergetic protons or electrons are maximum at the surface of the propellant, the deposition of protons has its minimum at the surface and increases linearly with depth up to the range of the protons. For the case of protons, the maximum surface dose rate depends primarily on the total number of protons striking the surface, and only slightly on their energy, so long as their energy is sufficient for them to clearly penetrate the surface medium. Illustrative calculations are carried out for the Freden and White spectrum of protons and for the Walt et al., spectrum of electrons incident on thin-walled stainless steel vehicles carrying liquid H_2 or liquid O_2. The numerical results for O_2 would be closely similar to those for biological materials. (auth)

21845 (AD-266034) THE SPACE ENVIRONMENT AND ITS INTERACTIONS WITH LIQUID PROPELLANTS AND THEIR STORAGE SYSTEMS. Norman M. Wiederhorn (Little (Arthur D.) Inc., Cambridge, Mass.). Sept. 1961. Includes Bibliography compiled by Russell J. Bowen, Robert P. Epple, Ann J. Jordan, D. Read Moffett, and James L. Schad. Contract NAS 5-664. 109p. (C-63270-12-1).

A discussion is presented of the pertinent factors of the space environment that influence the storage of liquid propellants in space and the mechanisms by which these may interact with a liquid propellant or its storage system. A bibliography of 147 references, with abstracts, on the space environment is included. (M.C.G.)

21846 (AD-268695) THE THEORY OF SURFACE IONIZATION AND ITS APPLICATION TO ION PROPULSION (thesis). Donald D. Mueller (Air Force Inst. of Tech., Wright-Patterson AFB, Ohio). Aug. 1961. 72p.

References on surface ionization and ion propulsion are reviewed. The Saha-Langmuir equation for a homogeneous surface with no adsorbed atoms was derived. The effects of a heterogeneous surface, adsorbed atoms, and electric fields are discussed in detail. After a brief description of experimental techniques and the extent to which the theory is confirmed by experiment, the application of the theory to ion propulsion is examined. Particular emphasis is placed on the porous plug ionizer. The areas in which future research should be directed are indicated. (auth)

21847 (AFOSR-2352) A REVIEW OF RECENT MHD GENERATOR WORK AT THE AVCO-EVERETT RESEARCH LABORATORY. T. R. Brogan, J. F. Louis, R. J. Rosa, and Z. J. J. Stekly (Avco Corp. Avco-Everett Research Lab., Everett, Mass.). Mar. 1962. Contract AF49(638)-1129. 20p. (AMP-74).

Presented at Third Symposium on the Engineering Aspects of Magnetohydrodynamics, Rochester, New York, March 28, 1962.

A general review is presented of work in the field of MHD power generation during the past year at the Avco-Everett Research Laboratory. The review includes the areas of conceptual plant design, electrical properties of gases, generator fluid mechanics and performance, field coil designs, and long duration testing. In the area of gas properties, the experimentally determined conductivity of seeded combustion products is in good agreement with predicted values at 2300 to 3000°K. The study of generator fluid mechanics continued during the past year using the Mark II combustion generator whose construction and initial operation was described at this meeting a year ago. Successful operation at Hall coefficients up to two was achieved. Performance of the Mark II generator is discussed. The discovery of high field strength superconducting alloys has important implications for MHD power generation, as well as for many other MHD devices. There is a brief description of these coils as applied to MHD generators, together with an assessment of the economic possibilities they present for use in a power plant. (auth)

21848 (LA-2677) PERFORMANCE OF OPTIMIZED MULTISTAGE ROCKETS. Ralph S. Cooper (Los Alamos Scientific Lab., N. Mex.). Jan. 1962. Contract W-7405-Eng-36. 59p.

The optimum number of stages for multistage rockets using a single type of propulsion was derived for several different assumptions concerning the structural parameters. Analytical approximations and more accurate numerical solutions are presented for both the optimum number of stages and the optimized vehicle performance. The results show that for optimized staging the individual stage mass ratios depend only on the structure factors and are independent of the exhaust velocity and mission requirement. The analysis also leads to the definition of an effective exhaust velocity or effective specific impulse that includes the effect of structure on the propulsion system performance and is independent of the mission requirement. Comparisons on the basis of gross weight, manufactured weight, and volume are made for chemical O_2-H_2, nuclear H_2, and a hypothetical nuclear pulse propulsion scheme, as functions of the mission velocity requirement. (auth)

21849 (WADD-TR-60-698(Pt.I)) DESIGN STUDY FOR ADVANCED SOLAR THERMIONIC POWER SYSTEMS. ITEM II. PART I. VAPOR TYPE THERMIONIC GENERATOR. (Thompson Ramo Wooldridge Inc., New Devices Labs., Cleveland and Thermo Electron Engineering Corp., Cambridge, Mass.). Sept. 1960. Contract AF 33(616)-7411. 106p. (ER-4166; AD-267330)

A survey of the state of the art of thermionic power generation was carried out as part of a design study for advanced solar thermionic power systems. The results of the survey are reported and serve as a basis for the preparation of a detailed design and test specification for two laboratory test models of thermionic generators. The Vapor Type Thermionic Generator and the Close-Spaced Vacuum Thermionic Generator are described. (auth)

21850 (AD-266765) A MAGNETOHYDRODYNAMIC GENERATOR WITH A ROCKET ENGINE. Translated from Przeglad Tech., No. 45, 10 (Nov. 9, 1960). 3p.

The development of magnetohydrodynamic generators is discussed. (M.C.G.)

21851 SCALE EFFECTS ON ION ROCKET PERFORMANCE. Paul D. Reader (NASA Lewis Research Center, Cleveland). ARS (Am. Rocket Soc.) J., 32: 711-14 (May 1962).

Two geometrically similar sources, a 5- and a 20-cm dia. beam source, were scaled from a 10-cm dia. source to allow a performance comparison. The three ion sources are compared for ion chamber characteristics and over-all engine efficiency. The results of the chamber investigations are compared with scaling variations indicated by simple plasma theory. The effects of size on operating limits are also discussed. Mercury was used as the propellant. (auth)

21852 ZERO GRAVITY PROBLEMS IN SPACE POWERPLANTS: A STATUS SURVEY. Walter Unterberg and James Congelliere (North American Aviation, Inc., Canoga Park, Calif.). ARS (Am. Rocket Soc.) J., 32: 862-72(June 1962).

A review is given of various hydromechanical and heat transfer systems that are adversely affected by zero-gravity operation. Methods for experimentally producing zero gravity, including drop tests, aircraft parabolic trajectories, and rockets and satellites, are described and compared. In space power systems, the absence of gravity influences the hydrostatic, hydrodynamic, and lubrication characteristics of components, as well as the convection, boiling, and condensation behavior of heat transfer systems. The design of components to overcome zero-g adversities is discussed. (T.F.H.)

21853 ELECTRIC SPACECRAFT—PROGRESS 1962. David B. Langmuir (Space Technology Labs., Inc., Los Angeles). Astronautics, 7: No. 6, 20-5(June 1962).

A discussion of the papers presented at the ARS Electric Propulsion Conference is given. Developments in electromagnetic and electrostatic propulsion and arcjets are described. (M.C.G.)

21854 FEASIBILITY OF ARCJET-PROPELLED SPACECRAFT. M. I. Yarymovych, F. A. deWiess, and R. R. John (AVCO Corp., Wilmington, Mass.). Astronautics, 7: No. 6, 36-42(June 1962).

The use of the electrothermal arcjet in propulsion of spacecraft is discussed. A method described for overcoming material limitations and extending the upper specific impulse limit of existing arcjet engines to possibly 3000 sec is the use of a crossed-field accelerator. The advantages of arcjets including greater payload capability and the availability of electrical power are outlined. The arcjet mission that shows the greatest promise of early achievement is the 24-hr communications satellite. A comparison is presented of the various missions contemplated for arcjet propulsion. The problems still unsolved in this method of propulsion are discussed. (M.C.G.)

21855 ELECTROSTATIC GENERATORS FOR SPACECRAFT. A. S. Denholm, C. N. Coenraads, and F. J. McCoy (Goodrich-High Voltage Astronautics, Inc., Burlington, Mass.). Astronautics, 7: No. 6, 46-50; 53(June 1962).

Power requirements and systems concepts of electrostatic generators for space vehicles are discussed. Topics covered include the conversion principle, practical field strengths in space, and the generator as a system component. (M.C.G.)

21856 TOWARD COLLOID PROPULSION. A. Lucile Cox (Goodrich-High Voltage Astronautics, Inc., Burlington, Mass.). Astronautics, 7: No. 6, 56-9(June 1962).

The use of charged colloidal particles as the propellant in an electrostatic engine is discussed. Colloid propulsion is compared with other propulsion methods. An evaluation of colloid sources is presented. Various approaches to the charging and dispersing of fine powders are described. (M.C.G.)

21857 NUCLEAR ENERGY AND SPACE PROBLEMS. Georges Fleury. Énergie nucléaire, 4: 78-84(Mar.-Apr. 1962). (In French)

The development of space missions depends on the realization of concentrated energy sources for propulsion and on-board power supplies. Nuclear sources have characteristics amenable to these needs. The problems posed and the solutions worked out in the United States are reviewed, viz. SNAP, Rover, and Kiwi. Particular attention is given to the SNAP systems, which utilize either a light fission reactor or radioelements, and which can be of two types: direct propulsion nuclear reactors; or reactors for the production of electrical energy (furnishing propulsion or high power on board). (auth)

21858 ELECTROSTATIC ROCKET PROPULSION. Charles H. Stockman (Goodrich-High Voltage Astronautics, Inc., Burlington, Mass.). ISA Journal, 9: No. 6, 25-8(June 1962).

The principles of operation and the state of the art for electrostatic propulsion devices are described. Topics covered include electrostatic propulsion principles, contrast between electrostatic and chemical rockets, ion rocket applications, power sources, types of electrostatic motors, beam neutralization, and instrument problems. (M.C.G.)

WASTE DISPOSAL AND PROCESSING

Refer also to abstract 20314.

21859 (BM-RI-6011) DISPOSAL OF RADIOACTIVE WASTE IN THE VITRO-TYPE URANIUM MILLING FLOWSHEET. K. E. Tame, E. G. Valdez, and J. B. Rosenbaum (Bureau of Mines. Salt Lake City Metallurgical Research Center). Oct. 1961. 13p.

Pollution from radioactive nuclides, principally Ra^{226}, in liquid waste from uranium mills can be minimized by reusing the waste solution within the mill. Such reuse of waste solution in an acid leaching process for dissolution of the uranium, countercurrent decantation for liquid-solid separation and washing, and amine solvent extraction for recovery of the uranium from solution was investigated. The simulated reuse of barren raffinate in the mill circuit was carried through two separate laboratory campaigns of 29 and 31 cycles. Conventional chloride stripping of the amine was employed in the first campaign, whereas nitrate stripping was used in the second campaign. Dissolution of uranium from the ore in the acid leaching circuit averaged 90%. Washing efficiencies of 98 to 99% were attained by using 4 volume tons of combined raffinate and makeup water per ton of ore. Uranium recovery from the pregnant solution using a 5% solution of amine LA-1 in kerosene ranged from 99.3 to 99.9%. In the first campaign, the loaded organic was stripped with a 1.5 molar sodium chloride solution acidified to pH 1.0 with sulfuric acid. Recycle of organic in the chloride form and the reuse of barren raffinate in the washing circuit combined to cause a buildup of chlorides in the pregnant solution, which adversely affected uranium extraction by the amine. Control of the chloride level was attained by use of a soda ash scrub on a portion of the stripped organic. Uranium recovery was 99.9% when 42% of the organic flow was scrubbed, whereas the extraction dropped to 99.6% when only 17% of the organic was scrubbed. Molybdenum, which is coextracted with the uranium, also was purged by use of the soda ash scrub. Use of ammonium nitrate as an alternative to sodium chloride for stripping was investigated. The stripped organic was scrubbed with ammonium hydroxide solution to remove nitrates, and the scrub liquor subsequently acidified with nitric acid for use in stripping uranium from loaded amine. No marked advantage for either stripping system was apparent. The radioactivity in the pregnant solution and raffinate ranged from 300 to 800 disintegrations per minute (d.p.m.) of Ra^{226} per liter, which appeared to be the saturation limit, and did not increase upon continued recycle of the raffinate. Reuse of waste solutions in the mill circuit appears feasible for attaining a 75% reduction in the discard of dissolved radionuclides. (auth)

21860 (DLCS-1690203) RADIOACTIVE WASTE DISPOSAL SYSTEM PERIODIC RADIATION MONITORING SURVEY. CORE I, SEED 1. Test Results (T-612075). Section 2. (Duquesne Light Co., Shippingport, Penna.). [Oct. 1960]. Contract [AT(11-1)-292]. 14p.

Radiation levels were determined at all permanently installed monitored points in the disposal area. Radiation levels were found to be generally higher than those measured during the previous test but within Health Physics limitations. (J.R.D.)

21861 DECONTAMINATION FACTOR OF A RADIOCHEMICAL WASTE EVAPORATOR SYSTEM. Tetsuo Mamuro, Takashi Matsumura, Toshio Ishiyama, Kazuko Yoshikawa, and Takashi Karino. Ann. Rept. Radiation Center Osaka Prefect., 2: 24-32(1961). (In English)

This paper was previously abstracted from the original language and appears in NSA, Vol. 16, abstract no. 14372.

21862 STUDY ON THE TREATMENT OF RADIOACTIVE WASTE WATER BY FLOCCULATION. Takashi Matsumura, Toshio Ishiyama, Takashi Karino, and Tetsuo Mamuro. Ann. Rept. Radiation Center Osaka Prefect., 2: 33-42(1961). (In English)

The removal efficiencies of various radionuclides through three types of flocculation were investigated. (1) Bentonite-polyelectrolyte flocculation. Ba^{140}-La^{140}, Cs^{137}, Ce^{144}-Pr^{144}, Zr^{95}-Nb^{95}, and Ru^{106}-Rh^{106} were effectively removed, but I^{131}, P^{32}, and Sr^{89} were not removed satisfactorily. The effects of pH on Cs^{137} removal and of Na^{+} ion on Sr^{89} and Cs^{137} removal were studied. (2) Phosphate flocculation. Sr^{89}, Ce^{144}-Pr^{144}, and Ba^{140}-La^{140} were effectively removed, but not P^{32}, I^{131}, and Cs^{137}. (3) Ferric hydroxide flocculation. Ce^{144}-Pr^{144}, P^{32}, and Ba^{140}-La^{140} were effectively removed but not I^{131} and Cs^{137}. Removals were found to be larger in a recirculation type flocculator than in jar testers. (D.L.C.)

21863 RADIOACTIVE EFFLUENTS. Chem. Trade J., 148: 1631-62(1961).

A method was developed for the treatment of radioactive waste waters by chemical coagulation and ion exchange. Coagulation with lime, ferrous sulfate, and trisodium phosphate in an upward-flow sludge-blanket tank removes about 99% of the alpha-emitters and 89% of the beta-emitters. Residual activity is due largely to cesium, with traces of strontium and ruthenium, and this is removed by ion exchange in vermiculite columns; crude vermiculite is cheap and expendable and does not therefore need to be regenerated. If the waste waters contain large amounts of cesium, some of this can be removed before ion exchange by precipitation on copper ferrocyanide floc. The effluent can finally be treated by electrolytic de-ionization. (Publ. Health Eng. Abstr.).

21864 PROTECTION OF WATER AGAINST RADIOACTIVE POLLUTANTS. Josef Pfaffelhuber. Gas- u. Wasserfach, 101: 1295-6(Dec. 9, 1960).

A description of a new law concerning the prevention of pollution of water and air by radioactive materials is given. This law was effective September 1, 1960, and applies to conditions in Western Germany. (Publ. Health Eng. Abstr.).

21865 PURIFICATION OF RADIOACTIVE WASTE SOLUTIONS WITH NATURAL INORGANIC ION EXCHANGERS. III. THE EXCHANGE ADSORPTION OF CERIUM IONS AND RUTHENIUM AND ZIRCONIUM COMPLEXES ON RADGENDORF CLAY. G. Sachse (Zentralinstitut für Kernphysik, Rossendorf, Ger.) and E. Leibnitz. Kernenergie, 5: 114-17(Feb. 1962). (In German)

The results of the investigation of the exchange adsorption of cerium ions as a function of exchange velocity, pH value, and the concentration of the solution are described. Corresponding to the given maximum capacity of the clay for cerium ion, cerium activities of 185 c/g clay could be extracted. After a brief survey of the possible purification method for waste solutions containing Ru^{106} and Zr^{95}, the adsorption of Ru nitrosyl and Zr hydrolysis complexes on

Radgendorf bentonites is reported. A complete removal of Ru(NO) complexes using cation exchanging clay is not possible on the basis of the simultaneous presence of neutral and anionic complex forms in addition to colloidal compounds. Zr hydrolysis complexes were, however, well adsorbed in nitric acid solution. (tr-auth)

CORPORATE AUTHOR INDEX

This index contains entries for all report literature and, in addition, for certain published literature items for which it is felt that a corporate approach is especially desirable, e.g., symposia, conference proceedings, and meetings.

Each entry under a corporate author is a shortened version of the title of the publication, followed by the NSA volume and abstract number. Report numbers are given in parentheses.

The phrase "Progress report" is abbreviated as "Prog. rpt." This change permits a more rapid and complete alphabetical arrangement of the titles without changing the location of the progress report titles in relation to the other titles.

A

ACADEMIA R. P. R. INSTITUTUL DE FIZICĂ ATOMICĂ, BUCHAREST.
Distillation of isotopic mixtures in tapered conditions, 16: 20922 (IFA/DF/15)
Metal-to-metal and ceramics-to-metal seals, 16: 20566 (IFA/TV/14)
Tables of Clebsch–Gordon coefficients, 16: 21348 (IFA/FT/40)

ADVANCED TECHNOLOGY LABS. DIV. OF AMERICAN-STANDARD, MOUNTAIN VIEW, CALIF.
Prog. rpt. on burnout heat flux with boiling water, 16: 20591 (ATL-A-113)

AEROCHEM RESEARCH LABS., INC., PRINCETON, N. J.
Plasma jet as plasma source for advanced propulsion systems, 16: 21659 (AD-267135)

AEROJET-GENERAL CORP., AZUSA, CALIF.
Mercury corrosion loop testing, 16: 20972 (AGC-0584-04-2)
Prog. rpt. on resins and elastomers, 16: 20350 (AGC-0423-01-3)

AERONAUTICAL SYSTEMS DIV. MATERIALS CENTRAL, WRIGHT-PATTERSON AFB, OHIO.
Laboratory arc melting furnace, 16: 20989 (ASD-TN-61-32)

AEROPROJECTS, INC., WEST CHESTER, PENNA.
Prog. rpt. on welding refractory metals, 16: 20987 (AD-266249)

AEROSPACE CORP., EL SEGUNDO, CALIF.
Theta pinch experiments, 16: 21658 (AD-265829)

AIR FORCE INST. OF TECH., WRIGHT-PATTERSON AFB, OHIO.
Improving resolution of Van de Graaff Accelerator, 16: 21642 (AD-267612)
Surface ionization and ion propulsion, 16: 21846 (AD-268695)

AIR REDUCTION CO., INC. CENTRAL RESEARCH LABS., MURRAY HILL, N. J.
Fission product applications using β sources, 16: 20471 (NYO-9485)

AKTIEBOLAGET ATOMENERGI, STOCKHOLM.
Determination of pole figures with texture goniometer, 16: 21017 (AE-68)

ALLEGHENY LUDLUM STEEL CORP., BRACKENRIDGE, PENNA.
Prog. rpt. on Ta extrusion, 16: 20992 (ASD-TR-7-783(III))

ALLIED RESEARCH ASSOCIATES, INC., BOSTON.
Theoretical hydromagnetic shocks, 16: 21662 (AFSWC-TDR-62-42)

AMERICAN OIL CO. RESEARCH AND DEVELOPMENT DEPT., WHITING, IND.
Triplet excitation induced by electron irradiation. II., 16: 20467 (ASD-TDR-62-32(Pt.II))

ARGENTINA. COMISIÓN NACIONAL DE ENERGÍA ATÓMICA, BUENOS AIRES.
Beta transformations of Cu–Sn alloys, 16: 21040 (NP-11698)
Interaction of deuterons with N, 16: 21355 (NP-11697)
Ionization chamber for α-particle analysis, 16: 20643 (NP-11691)
Isotopic exchange of D, 16: 20923 (NP-11789)
Radiocesium in human diet, 16: 20856 (A/AC.82/G/L.746)

ARGONNE NATIONAL LAB., ILL.
Argonne Thermal Source Reactor, 16: 21714 (ANL-6440)
Calorimetry, 16: 20299 (ANL-6477(p.155-67))
Chemical-metallurgical processing, 16: 20297 (ANL-6477(p.29-105))
Determination of nuclear constants, 16: 20302 (ANL-6477(p.217-23))
Energy conversion, 16: 20301 (ANL-6477(p.204-16))
Fuel cycle applications of volatility and fluidization techniques, 16: 20298 (ANL-6477(p.106-54))
Measurement of energy and intensity of γ rays, 16: 20628 (ANL-6499)
Prog. rpt. on chemical engineering, 16: 20296 (ANL-6477)
Prog. rpt. on physics, 16: 21125 (ANL-6517)
Prog. rpt. on reactor development, 16: 21794 (ANL-6565)
Reactor decontamination, 16: 20303 (ANL-6477(p.224-30))
Reactor safety, 16: 20300 (ANL-6477(p.168-203))

ARMED SERVICES TECHNICAL INFORMATION AGENCY, ARLINGTON, VA.
Bibliography on plasma physics and MHD, 16: 21660 (AD-271170)

ARMY ORDNANCE MISSILE COMMAND, REDSTONE ARSENAL, ALA.
Neutron partial cross section studies, 16: 21352 (NP-11667)

ARMY RESEARCH OFFICE, DURHAM, N. C.
Prog. rpt. on research, 1961, 16: 20043 (NP-11537)

ATOMIC ENERGY OF CANADA LTD., CHALK RIVER, ONT.
Dilution rate factors from reactor stack, 16: 20858 (AECL-1518)
Effect of fluoride on corrosion of Zy-2, 16: 20977 (CRGM-1082)
Nuclear power demonstration, 16: 21792 (AECL-1458)
Possible spectrochemical source, 16: 20304 (CRL-73)
Protective system design for reactors, 16: 21793 (AECL-1495)
Radiation damage in Zr, Zy-2, 410 stainless steel, 16: 21086 (AECL-1484)
Thermal neutron analyser, 16: 21333 (CRRP-1078)

ATOMICS INTERNATIONAL. DIV. OF NORTH AMERICAN AVIATION, INC., CANOGA PARK, CALIF.
Behavior of materials through stress-strain relationships, 16: 20806 (NAA-SR-6376)
Device for detection of H_2 in Na, 16: 20320 (NAA-SR-6986)
Fuel rod bowing in SRE, 16: 21722 (NAA-SR-6878)
Hydrogen permeation of oxide films on Zr, 16: 21035 (NAA-SR-6267)

AUSTRALIA. ATOMIC ENERGY COMMISSION.
Ninth annual report, 1960-61, 16: 20044 (NP-11606)

AUSTRALIA. ATOMIC ENERGY COMMISSION RESEARCH ESTABLISHMENT, LUCAS HEIGHTS, NEW SOUTH WALES.
Relocatable assembly system for IBM 1620, 16: 20928 (AAEC/E-87)
Solution of optimum design problems on digital computer, 16: 20555 (AAEC/E-85)

AVCO CORP. AVCO-EVERETT RESEARCH LAB., EVERETT, MASS.
Hall and ion slip effects in non-uniform gas, 16: 21119 (AFBSD-TR-61-80)
Infrared heat transfer gage, 16: 20589 (AFCRL-942)
Magnetohydrodynamic generator, 16: 21847 (AFOSR-2352)

B

BABCOCK AND WILCOX CO., LYNCHBURG, VA.
Calculation of neutron absorption in square lattice, 16: 21715 (BAW-154)
CETR core assembly physics and zero power tests, 16: 21795 (BAW-163)
Enriched UO_2 cores studied for NMSR, 16: 21257 (BAW-1216)
Physics program for SSCR, 16: 20863 (BAW-1215(and Suppl.1))
BABCOCK AND WILCOX CO. RESEARCH CENTER, ALLIANCE, OHIO.
Corrosion of C and low alloy steels, 16: 20976 (BW-3871)
BATTELLE MEMORIAL INST., COLUMBUS, OHIO.
Corrosion investigation of alloys, 16: 20974 (BMI-X-198)
Prog. rpt. on civilian applications, 16: 20041 (BMI-1574(Del.))
Prog. rpt. on engineering properties of K, 16: 21039 (NP-11671)
BATTELLE MEMORIAL INST. INTERNATIONAL DIV., GENEVA.
Prog. rpt. on effects of radiation on pressure vessel steels, 16: 21090 (EURAEC-140)
BEERS (ROLAND F.), INC., ALEXANDRIA, VA.
Effects of Gnome on public safety, 16: 20872 (PNE-128F)
BENDIX CORP., CINCINNATI.
Prog. rpt. on radiacmeter research, 16: 20625 (AD-265927)
BERN. UNIVERSITÄT.
Bibliography on thermoluminescence, 16: 21133 (TID-3911)
BIRMINGHAM SMALL ARMS, LTD., BIRMINGHAM, ENGLAND.
Tungsten–carbon equilibrium system, 16: 21022 (ASD-TDR-62-25(Pt.I))
BOEING CO., SEATTLE.
Kinetic theory of quantum plasmas, 16: 21664 (D1-82-0155)
Phase transformation in single-crystal $SrTiO_3$, 16: 21032 (D1-82-0163)
X-ray absorption fine structure, 16: 21126 (D1-82-0164)
BOOZ-ALLEN APPLIED RESEARCH, INC., GLENVIEW, ILL.
Prog. rpt. on analytical techniques, 16: 20324 (TID-15661)
BRITISH WELDING RESEARCH ASSN., LONDON.
Bibliography on pressure welding, 16: 20995 (NP-11776)
BROOKHAVEN NATIONAL LAB., UPTON, N. Y.
Physics of semiconductor radiation detectors, 16: 20629 (BNL-699)
Proceedings of 11th Annual AEC Corrosion Symposium, 16: 20975 (BNL-728)
Prog. rpt. on nuclear engineering, 16: 20042 (BNL-696)
BRUSSELS. CENTRE D'ÉTUDE DE L'ÉNERGIE NUCLEAIRE.
Prog. rpt. on fall-out at Mol, 16: 20812 (A/AC.82/G/L.711)
Prog. rpt. on fall-out at Mol, 16: 20813 (A/AC.82/G/L.721)
Prog. rpt. on retreatment of spent fuels, 16: 20541 (EURAEC-24)
BRUSSELS. UNIVERSITE.
Prog. rpt. on electrochemical transient methods in chemical analysis, 16: 20353 (EURAEC-241)
BUENOS AIRES. UNIVERSIDAD.
Angular correlations of nuclear radiations, 16: 21351 (NP-11651)
Direct reactions via single particle modes, 16: 21266 (NP-11680)
BUFFALO. UNIV.
Isotope applications in chemical kinetics, 16: 20361 (TID-15788)
Prog. rpt. on properties of carbons and graphites, 16: 21038 (NP-11665)
BUREAU OF MINES, WASHINGTON, D. C.
Gnome pre- and post-shot mine survey, 16: 20048 (PNE-134F)
BUREAU OF MINES, ROLLA, MO.
Radiation effects on chlorination of rutile, carbon, and catalysts, 16: 20468 (BM-RI-5994)
BUREAU OF MINES, SALT LAKE CITY.
Disposal of radioactive waste, 16: 21859 (BM-RI-6011)
Radioactive tracers in Be metallurgy, 16: 20950 (BM-RI-5980)
BUREAU OF YARDS AND DOCKS.
Blast protection for minimum cost, 16: 20869 (NP-11653)

C

CALIFORNIA INST. OF TECH., PASADENA.
High stress level fatigue, 16: 20805 (ARL-181)
CALIFORNIA. UNIV., BERKELEY.
Analyticity in complex angular momentum of S matrix, 16: 21698 (AFOSR-2400)
Solar flare x-ray burst, Sept. 1961, 16: 21238 (NP-11658)
CALIFORNIA. UNIV., BERKELEY. LAWRENCE RADIATION LAB.
Application of linear programming to linear differential equations, 16: 20932 (UCRL-10110)
Image intensifier-scintillator for weak beams, 16: 20642 (NP-11663)
Lectures on S-matrix theory, 16: 21267 (UCRL-9875(Vol.2))
Prog. rpt. on chemistry, 16: 20305 (UCRL-10023)
Regge trajectories for single attractive Yukawa potential, 16: 21268 (UCRL-10140)
Separation of immiscible liquids by gravity settling, 16: 20540 (UCRL-10048)
Total cross section of K^- mesons on nucleons, 16: 21360 (UCRL-10125)
CALIFORNIA. UNIV., LIVERMORE. LAWRENCE RADIATION LAB.
Emission characteristics of Ta, W, Re, Ir in plasma diodes, 16: 21138 (UCRL-6809)
Prog. rpt. on hazards control, 16: 20875 (UCRL-6818)
Scattering of acoustic and elastic waves by surfaces of arbitrary shape, 16: 21137 (UCRL-6779)
Stress history measurements at Gnome, 16: 20808 (PNE-105P)
TORY II-A design, 16: 21822 (UCRL-6305)
CAROLINAS VIRGINIA NUCLEAR POWER ASSOCIATES, INC., CHARLOTTE, N. C.
Instrument valves for flow measurement and sampling system, 16: 20631 (CVNA-140)
Prog. rpt. on CVTR Project, 16: 21825 (WCAP-4121)
Reactivity coefficients in UO_2–D_2O two-region lattice, 16: 21716 (CVNA-114)
CHICAGO OPERATIONS OFFICE, AEC.
Nuclear Superheat Meeting No. 5, 16: 21817 (TID-7630)
CHICAGO. UNIV. LABS. FOR APPLIED SCIENCE.
Proportional counter telescope, 16: 20626 (AD-269307)
CHILE. INSTITUTO DE INVESTIGACIONES GEOLÓGICAS, SANTIAGO.
Reconnaissance for U in Chile, 16: 20820 (RME-4568)
CHROMALLOY CORP. PROPELLEX CHEMICAL DIV., EDWARDSVILLE, ILL.
Prog. rpt. on explosive forming of metals, 16: 20994 (NP-11621)
CHRYSLER CORP., DETROIT.
Prog. rpt. on semiconductors for thermoelectric power generation, 16: 21111 (AD-265106)
COLUMBIA UNIV., NEW YORK.
Prog. rpt. on electromagnetic spectrum, 16: 21129 (NP-11640)
Prog. rpt. on heat transfer, 16: 20593 (TID-15637)
COLUMBIA UNIV., PALISADES, N. Y. LAMONT GEOLOGICAL OBSERVATORY.
Strontium-90 assay of environmental materials, 16: 20870 (NYO-9934 (Vol.III) Ext.
COMBUSTION ENGINEERING, INC., WINDSOR, CONN.
Prog. rpt. on nuclear superheater, 16: 21812 (GNEC-230)
Prog. rpt. on UO_2 fuel systems, 16: 20951 (CEND-149)
CONSOLIDATED EDISON CO. OF NEW YORK, INC.
CETR core assembly physics and zero power tests, 16: 21795 (BAW-163)
CORNELL UNIV., ITHACA, N. Y.
Magnetic resonance of Li V bronze, 16: 21123 (AFOSR-1959)
Radiation damage on lunar surface, 16: 21132 (NP-11652)

D

DEFENSE ATOMIC SUPPORT AGENCY, WASHINGTON, D. C.
Effects of nuclear weapons, 16: 20908
DENMARK. ATOMENERGIKOMMISSIONEN. FORSØGSINSTITUT, RISÖ.
Relaxation phenomena behind strong shock in H. I., 16: 21666 (RISÖ-35)
DIAMOND ORDNANCE FUZE LABS., WASHINGTON, D. C.
Gamma-induced photoconductivity in capacitor, 16: 21088 (DOFL-TR-1037)
DIVISION OF LICENSING AND REGULATION, AEC.
Calculation of distance factors for reactor sites, 16: 21726 (TID-14844)
DIVISION OF OPERATIONS ANALYSIS AND FORECASTING, AEC.
Multicomponent cascade theory, 16: 20924 (TID-15054)
DIVISION OF RAW MATERIALS, AEC.
Reconnaissance for U in Peru, 16: 20818 (RME-4517)
Reconnaissance for U in Peru, 16: 20819 (RME-4521)
Reconnaissance for U in Chile, 16: 20820 (RME-4568)
DIVISION OF REACTOR DEVELOPMENT, AEC.
Coolant and fuel element technology, 16: 21818 (TID-14978)
DRESSER PRODUCTS, INC., GREAT BARRINGTON, MASS.
Effects of neutron capture on reactor control materials, 16: 21094 (NP-

11708)

DU PONT DE NEMOURS (E. I.) & CO. EXPLOSIVES DEPT., WILMINGTON, DEL.
Prog. rpt. on heavy water reactors, 16: 21810 (DP-725)

DU PONT DE NEMOURS (E. I.) & CO. SAVANNAH RIVER LAB., AIKEN, S. C.
Contamination and decontamination of reactors, 16: 21717 (DP-682)
Leakage of water from pump seals, 16: 20564 (DP-666)
Stress-corrosion cracking of stainless steel, 16: 20978 (DP-683)
Transistor circuits for remote BF, counters, 16: 20634 (DP-692)

DUQUESNE LIGHT CO., SHIPPINGPORT, PENNA.
Calibration of control rods, 16: 21797 (DLCS-1500103)
Calibration of reactor plant flow instrumentation, 16: 21807 (DLCS-3370103(Rev.))
Charging and discharging of demineralizer resins, 16: 21802 (DLCS-1800102)
Coefficients of reactivity, Core I, Seed 2, 16: 21798 (DLCS-1510108)
Coefficients of reactivity, Core I Seed 2, 16: 21799 (DLCS-1510109)
Coefficients of reactivity at power, 16: 21800 (DLCS-1510205)
Governor performance tests, Core I, Seed 2, 16: 21801 (DLCS-1740405)
Prog. rpt. on PWR operation, 16: 21821 (TID-15502)
Purification system performance, 16: 21804 (DLCS-2130102)
Radiation contamination levels during refueling, 16: 21806 (DLCS-3170101)
Radiation survey of reactor plant after shutdown, 16: 21803 (DLCS-1840402)
Rapid station shutdown, 16: 21808 (DLCS-3440103)
Reactor plant container integrity test, 16: 21809 (DLCS-3570105)
Waste disposal system material balance, 16: 21805 (DLCS-2390301)
Waste disposal system periodic monitoring survey, 16: 21860 (DLCS-1690203)

DYNATECH CORP., CAMBRIDGE, MASS.
Design of fuel assembly flow control, 16: 21727 (TID-15473)
Prog. rpt. on flow balancing device in BWR, 16: 21820 (TID-15436)

E

ELECTRO-OPTICAL SYSTEMS, INC., PASADENA, CALIF.
Prog. rpt. on quenching metallic systems, 16: 21011 (AD-264988)
Prog. rpt. on semiconductors for thermoelectric power generation, 16: 2112 (AD-266009)

EUROPEAN ATOMIC ENERGY COMMUNITY.
EAEC fourth report, April 1960–March 1961, 16: 20045 (NP-11611)

EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH, GENEVA.
Detection and production of polarized particles, 16: 21262 (CERN-62-8)
Elementary particle physics lecture courses, 16: 21263 (CERN-62-14)
Injection system for CERN storage ring model, 16: 21644 (CERN-62-4)
Low-energy particles from CERN PS, 16: 21645 (CERN-62-19)
Relativistic quantum mechanics lectures, 16: 21699 (CERN-62-15)
Theoretical analysis of control of IEP 3, 16: 20630 (CERN-62-1)

F

FIAT. SEZIONE ENERGIA NUCLEARE, TURIN.
Prog. rpt. on hot channel and hot spot calculations, 16: 20592 (EURAEC-264)
Prog. rpt. on sintering UO_2, 16: 20996 (EURAEC-2)
Prog. rpt. on swaging UO_2, 16: 20997 (EURAEC-10)

FOREST PRODUCTS LAB., MADISON, WIS.
Thermal protection by window glass, 16: 20860 (AFSWP-792)

FRANCE. COMMISSARIAT À L'ÉNERGIE ATOMIQUE, PARIS.
Prog. rpt. on sintered UO_2, 16: 21091 (EURAEC-248)
Prog. rpt. on U–UC cermets, 16: 20998 (EURAEC-220)
Prog. rpt. on U–UC cermets, 16: 20999 (EURAEC-247)

FRANCE. COMMISSARIAT À L'ÉNERGIE ATOMIQUE. CENTRE D'ÉTUDES NUCLÉAIRES, SACLAY.
Behavior of fission gases in UO_2, 16: 21043 (AEC-tr-5103)
Prog. rpt. on UC shaping and irradiation, 16: 20952 (EURAEC-71)

FRANKLIN INST., PHILADELPHIA.
Prog. rpt. on high-purity Be, 16: 20958 (NP-11702)

G

GENERAL ATOMIC DIV., GENERAL DYNAMICS CORP., SAN DIEGO, CALIF.
Prog. rpt. on radiation effects on Si solar cells, 16: 21092 (GACD-3001)

GENERAL ELECTRIC CO. AIRCRAFT NUCLEAR PROPULSION DEPT., CINCINNATI.
Absorption cross section of stable, low cross section fission products, 16: 21361 (XDC-60-1-141)
Alternate fastener survey, 16: 20563 (DC-60-12-129)
Apparatus for evaluating thermal stress resistance of materials, 16: 21030 (DC-60-3-110)
Balanced reverse folded flow study, 16: 20595 (XDC-60-1-158)
Bare reactor analysis, 16: 21728 (XDC-60-1-211)
Beryllium neutron cross sections, 16: 21334 (DC-60-12-98)
Coated refractory metal, 16: 21031 (DC-60-8-25)
Design calculations for quick disconnects, 16: 20561 (DC-59-9-154)
Fabrication of thermocouples, 16: 20633 (DC-59-10-202)
Fast neutron attenuation functions, 16: 21335 (XDC-60-2-76)
Friction and wear of metallided surfaces, 16: 21029 (DC-60-1-146)
Gamma irradiation of turbojet accessory systems, 16: 21096 (XDC-60-2-116)
Gas dynamic system for heating air, 16: 20559 (DC-59-5-41)
Isotopic history trace, 16: 20935 (XDC-60-3-211)
Photostress techniques, 16: 21026 (DC-59-6-224 and Add.)
Pressure vessel strain concentrations, 16: 21027 (DC-59-12-216)
Project 100 task reports, 16: 21796 (DC-55-6-7)
Shield computer program 18-0, 16: 21691 (DC-60-7-9)
Stress oxidation of Ni–Cr fuel elements, 16: 21028 (DC-60-1-108)
System for heating clean air to 3100°F, 16: 20560 (DC-59-6-253)
Viewing studies for remote handling, 16: 20562 (DC-60-8-32)
Water-gas reaction in vapor plating alumina, 16: 20352 (DC-59-3-200)

GENERAL ELECTRIC CO. AIRCRAFT NUCLEAR PROPULSION DEPT., IDAHO FALLS, IDAHO.
Calibration of P102 nuclear sensors, 16: 20632 (DC-59-6-743)
Ion chamber calibration and endurance test, 16: 20648 (XDCL-59-2-722)

GENERAL ELECTRIC CO. ELECTRONICS LAB., SYRACUSE, N. Y.
Prog. rpt. on thermocouple energy converters, 16: 21109 (AD-237966)
Prog. rpt. on thermocouple energy converters, 16: 21110 (AD-251485)
Prog. rpt. on thermocouple energy converters, 16: 21131 (NP-11647)

GENERAL ELECTRIC CO. FLIGHT PROPULSION LAB. DEPT., CINCINNATI.
Prog. rpt. on alkali metal containment, 16: 21037 (NP-11614)
Prog. rpt. on reactor instrumentation and control, 16: 21718 (GEMP-72)

GENERAL ELECTRIC CO. GENERAL ENGINEERING LAB., SCHENECTADY, N. Y.
Compact power plants, 16: 20558 (AD-269397)
Force and torque variations of double-acting "steamotor," 16: 20556 (AD-269392)
Liquid shear transmission, 16: 20557 (AD-269396)

GENERAL ELECTRIC CO. HANFORD ATOMIC PRODUCTS OPERATION, RICHLAND, WASH.
Boron steel for reactor thermal shielding, 16: 21034 (HW-SA-2583)
Creep of Zy-2, 16: 21033 (HW-70151)
Direct hydrofluorination of Pu(III) oxalate, 16: 20354 (HW-19771)
Hanford raindrop sampler and selected spectra, 16: 20565 (HW-73119)
Measurement of U burnup, 16: 20317 (HW-72199)
Microstructure of U, 16: 20953 (HW-73476)
Nuclear safety specs. for enriched fuel elements, 16: 20867 (HW-70351 (Rev.))
Radiological conditions in vicinity of Hanford, 16: 20868 (HW-71999)
Zirconium oxide corrosion product, 16: 20979 (HW-71958-RD)

GENERAL ELECTRIC CO. MISSILE AND SPACE VEHICLE DEPT., PHILADELPHIA.
Prog. rpt. on structural response to electromagnetic radiation, 16: 21087 (AFOSR-2483)

GENERAL MILLS, INC., MINNEAPOLIS.
Physical sputtering, 16: 21115 (AD-267458(Pt.I))
Prog. rpt. on sputtering yields, 16: 21114 (AD-267458)
Sputtering yields at low ion energies, 16: 21116 (AD-267458(Pt.V))

GENERAL NUCLEAR ENGINEERING CORP., DUNEDIN, FLA.
Prog. rpt. on nuclear superheater, 16: 21812 (GNEC-230)
GLADDING, McBEAN AND CO., LOS ANGELES.
Flat plate ceramic fuel elements, 16: 21819 (TID-15373)
GOODYEAR TIRE AND RUBBER CO., AKRON, OHIO.
Radioisotope dating, 16: 20909 (TID-15034)
GT. BRIT. ADMIRALTY MATERIALS LAB., POOLE, DORSET, ENGLAND.
Activation analysis of light elements, 16: 20321 (NP-11608)
GT. BRIT. ATOMIC ENERGY RESEARCH ESTABLISHMENT, HARWELL, BERKS, ENGLAND.
Corrected dimensions for MRG accelerator, 16: 21643 (AERE-Memo-G/M-37)
GT. BRIT. NATIONAL INST. FOR RESEARCH IN NUCLEAR SCIENCE, HARWELL, BERKS, ENGLAND.
Nimrod external proton beam, 16: 21649 (NIRL/R/12)
GT. BRIT. SERVICES ELECTRONICS RESEARCH LAB., BALDOCK, HERTS, ENGLAND.
Neutron yield from Ti–T targets under deuteron bombardment, 16: 21358 (SERL-TR-M-61)

H

HAHN-MEITNER-INSTITUT FUR KERNFORSCHUNG BERLIN.
Prog. rpt. on diffusion of inert gases, 16: 21047 (EURAEC-17)
Prog. rpt. on diffusion of inert gases, 16: 21048 (EURAEC-18)
Prog. rpt. on diffusion of fission gases in nuclear fuels, 16: 21049 (EURAEC-121)
HOLMES AND NARVER, INC., LOS ANGELES.
Gnome pre- and post-shot structure survey, 16: 20047 (PNE-127F)

I

IDAHO. UNIV., MOSCOW.
Boron steel for reactor thermal shielding, 16: 21034 (HW-SA-2583)
ILLINOIS INST. OF TECH., CHICAGO. ARMOUR RESEARCH FOUNDATION.
Brazing of Mo sheet, 16: 20988 (ARF-2232-2)
Brittle behavior of ceramic materials, 16: 21020 (ARF-8203-18)
Prog. rpt. on ductile Be composites, 16: 21019 (ARF-2212-5)
Prog. rpt. on Zr alloys, 16: 20973 (ARF-2198-18)
ILLINOIS. UNIV., URBANA.
Drift mobilities and space-charge-limited currents in films, 16: 21018 (AFOSR-1416)
Neutral particles in 30° beam from AGS, 16: 21650 (NP-11624)
INDIA. ATOMIC ENERGY ESTABLISHMENT, TROMBAY.
Fast fission factor in heterogeneous lattices, 16: 21710 (AEET/RE/1)
Radioactive equilibrium, 16: 21345 (AEET/HP/4)
INTERNATIONAL ATOMIC ENERGY AGENCY, VIENNA.
Conference on nuclear electronics. I., 16: 20706
Conference on nuclear electronics. II., 16: 20757
INTERNATIONAL INST. OF NUCLEAR SCIENCE AND ENGINEERING, ARGONNE, ILL.
Hazards report on AGN-201 reactor, 16: 20862 (ANL-6510)
ISOTOPES, INC., WESTWOOD, N. J.
Studies of nuclear debris in precipitation, 16: 20816 (NYO-9531)
ISRAEL. ATOMIC ENERGY COMMISSION, REHOVOTH.
Lithium and Li-6 analysis by counting delayed neutrons, 16: 20318 (IA-690)
Stability of mixed complexes, 16: 20355 (IA-731)
ITALY. COMITATO NAZIONALE PER L'ENERGIA NUCLEARE, ISPRA.
Design for reactor safety systems, 16: 21724 (NP-11701)
ITALY. ISTITUTO SUPERIORE DI SANITÀ, ROME.
Detection of neutral meson in H, 16: 20635 (ISS-61/7)
Program for calculation of telescope angles, 16: 20636 (ISS-61/17)

J

JAPAN ATOMIC ENERGY RESEARCH INST., TOKYO.
JAERI neutron crystal spectrometer, 16: 20637 (JAERI-1030(Suppl.))
JOHNS HOPKINS UNIV., BALTIMORE.
Stream survey of U mining and milling area, 16: 20815 (NYO-7831)
JOINT INST. FOR NUCLEAR RESEARCH, DUBNA, U.S.S.R.
Discharge in a spark chamber along particle track, 16: 20638 (JINR-D-870)
Energy spectrum of resonance absorption of γ rays in Zn-67, 16: 21382 (AEC-tr-5115)
Scattering of Λ and K_1^0 on H_2, 16: 21264 (JINR-D-820)
Singularities in kinetic equations, 16: 20639 (JINR-P-869)

K

KANSAS. UNIV., LAWRENCE.
Bibliography on thermoluminescence, 16: 21133 (TID-3911)
KERNFORSCHUNGSANLAGE, JÜLICH, GERMANY.
Cation exchange properties of inorganic materials, 16: 20356 (JUL-33-RC)
KNOLLS ATOMIC POWER LAB., SCHENECTADY, N. Y.
Gross fission product poisoning, 16: 21814 (KAPL-M-ECH-8)
Reactor fuel matrix cooled by free convection, 16: 21720 (KAPL-M-PF-4)

L

LADISH CO., CUDAHY, WIS.
Prog. rpt. on Be forging, 16: 20991 (ASD-TR-7-647(VI))
LITTLE (ARTHUR D.) INC., CAMBRIDGE, MASS.
Materials for vacuum insulation, 16: 20590 (ASD-TDR-62-88)
Space environment and its interactions with propellants, 16: 21845 (AD-266034)
LOCKHEED AIRCRAFT CORP., SUNNYVALE, CALIF.
Bibliography on all-metal sandwiches, 16: 20957 (NP-11677)
Bibliography on Be, 16: 20956 (NP-10640(Suppl.II))
LOS ALAMOS SCIENTIFIC LAB., N. MEX.
Bibliography on perturbation effects in EM cavity resonators, 16: 21882 (TID-15417)
Performance of optimized multistage rockets, 16: 21848 (LA-2677)
Thermal calibration of converted PeeWee neutron survey instrument, 16: 20640 (LAMS-2697)
LOVELACE FOUNDATION FOR MEDICAL EDUCATION AND RESEARCH, ALBUQUERQUE, N. MEX.
Prog. rpt. on biological effects of blast, 16: 20864 (DASA-1242)

M

MALLINCKRODT CHEMICAL WORKS. URANIUM DIV., WELDON SPRING, MO.
Prog. rpt. on feed materials, 16: 20525 (MCW-1472)
MARQUARDT CORP., VAN NUYS, CALIF.
Effects of elevated temperatures on alloys, 16: 21025 (ASD-TR-61-69)
MARTIN CO., BALTIMORE.
Prog. rpt. on SNAP 7 program, 16: 21127 (MND-P-2483-5)
Program for multiple lethargy level cell corrections for slab cells, 16: 21721 (MND-C-2500-2)
MARYLAND. UNIV., COLLEGE PARK.
Deuteron widths in 1p-shell nuclei, 16: 21354 (NP-11682)
Lectures on scattering theory, 16: 21260 (AFOSR-2409)
Radiation magnetogasdynamics, 16: 21124 (AFOSR-2674)
Shell model analysis of $B^{11}(d,n)C^{12}$, 16: 21353 (NP-11681)
Wave motion in plasma with anisotropic pressure, 16: 21665 (NP-11669)
MASSACHUSETTS INST. OF TECH., CAMBRIDGE.
Grain boundary sliding in Al and its alloys, 16: 21024 (ASD-TR-61-33)
Radiation dose in space vehicles, 16: 21844 (AD-263476)
Reduced widths in (d,p) stripping experiments, 16: 21356 (NYO-2666)
MELLON INST., PITTSBURGH.
Prog. rpt. on radiation research, 16: 20472 (RRL-79)
METALLGESELLSCHAFT A. G., FRANKFURT AM MAIN.
Prog. rpt. on Zr–Nb alloys, 16: 20980 (EURAEC-26)
Prog. rpt. on Zr–Nb alloys, 16: 20981 (EURAEC-27)
Prog. rpt. on Zr–Nb alloys, 16: 20982 (EURAEC-85)
METCUT RESEARCH ASSOCIATES INC., CINCINNATI.
Prog. rpt. on machining refractory materials, 16: 20990 (ASD-TR-7-532(VI))
MICHIGAN. UNIV., ANN ARBOR.
Effect of γ' particle size on Ni alloys, 16: 21008 (AD-263483)

Image intensifier-scintillator for weak beams, 16: 20642 (NP-11663)
Interaction of EM fields with plasmas, 16: 21661 (AFCRL-746)
Status of the scintillation chamber, 16: 20641 (NP-11616)
Study of seeded plasma, 16: 21663 (ARL-62-310)

MIDWESTERN UNIVERSITIES RESEARCH ASSN., MADISON, WIS.
PARMESH dynamics program-III, 16: 20929 (MURA-635)
Perturbation theory for accelerators, 16: 21648 (MURA-634)

MONSANTO RESEARCH CORP. DAYTON LABS., OHIO.
Prog. rpt. on shielding materials, 16: 21690 (AD-267561L)

N

NARMCO RESEARCH AND DEVELOPMENT. DIV. OF TELECOMPUTING CORP., SAN DIEGO, CALIF.
Prog. rpt. on structural adhesives, 16: 20959 (NP-11703)

NATIONAL BUREAU OF STANDARDS, WASHINGTON, D. C.
Manual of radioactivity procedures, 16: 20904
Polarization of γ rays from neutral particle decays, 16: 21265 (NP-11600)
Ultraviolet multiplet table, 16: 20357 (NBS-C-488(Sect.3))
Ultraviolet multiplet table, 16: 20358 (NBS-C-488(Sect.4))

NATIONAL CO., INC., MALDEN, MASS.
Coupled electron and nuclear spin systems, 16: 21357 (RADC-TR-61-132)

NATIONAL LEAD CO. OF OHIO, CINCINNATI.
Hot rotary forging of U tubing, 16: 20993 (NLCO-842)

NATIONAL RESEARCH COUNCIL. COMMITTEE ON NUCLEAR SCIENCE.
Chromatographic and electromigration techniques in radiochemistry, 16: 20469 (NAS-NS-3106)
Conference on electromagnetic lifetimes and nuclear states, Gatlinburg, Oct-5-7, 1961, 16: 21431 (NAS-NRC-Pub-974)

NAVAL CIVIL ENGINEERING LAB., PORT HUENEME, CALIF.
Attenuation of γ radiation in 2-legged rectangular duct, 16: 21692 (NP-11657)

NAVAL RADIOLOGICAL DEFENSE LAB., SAN FRANCISCO.
Water transport of particulate matter, 16: 20594 (USNRDL-TR-436)

NAVAL RESEARCH LAB., WASHINGTON, D. C.
Prog. rpt. on nuclear science, 16: 21130 (NP-11643)

NEW MEXICO. UNIV., ALBUQUERQUE. ENGINEERING EXPERIMENT STATION.
Hypersonic plasma generator, 16: 21139 (UNM-TR-EE-73)

NEW YORK UNIV., NEW YORK.
Intermetallic compounds, the chalcopyrites, 16: 21007 (AD-230373)
Prog. rpt. on solid state radiation-induced phenomena, 16: 20470 (NP-11604)

NEW ZEALAND. DOMINION X-RAY AND RADIUM LAB., CHRISTCHURCH.
Annual report for 1961, 16: 20866 (DXRL-AR/12)

NORAIR. DIV. OF NORTHROP CORP., HAWTHORNE, CALIF.
Effect of thermal histories on material strength, 16: 21023 (ASD-TR-61-194)

NORGES TEKNISKE HOGSKØLE, TRONDHEIM.
Polarization of γ rays from neutral particle decays, 16: 21265 (NP-11600)

NORTH CAROLINA STATE COLL., RALEIGH.
Geometric buckling of cylindrical assembly, 16: 21330 (AD-267646)

NORTHWESTERN UNIV., EVANSTON, ILL.
Prog. rpt. on materials research, 16: 21010 (AD-264878)

NORWAY. INSTITUTT FOR ATOMENERGI. OECD HALDEN REAKTOR PROSJEKT.
Experiments with HBWR first fuel charge, 16: 21813 (HPR-21)

NUCLEAR DEVELOPMENT CORP. OF AMERICA, WHITE PLAINS, N. Y.
Feasibility study of fast U^{233}–Th breeders, 16: 21723 (NDA-2134-3)

NUCLEAR METALS, INC., CONCORD, MASS.
Prog. rpt. on metallurgy, 16: 20954 (NMI-2104)
Prog. rpt. on metallurgy, 16: 20955 (NMI-2105)
Prog. rpt. on refractory phase diagrams, 16: 21036 (NMI-9235)

NUCLEAR UTILITY SERVICES, INC., WASHINGTON, D. C.
Yankee operating data, 16: 21816 (NYO-2482)

O

OAK RIDGE GASEOUS DIFFUSION PLANT, TENN.
Gravimetric factors for U, 16: 20319 (K-1476(Rev.1))

OAK RIDGE NATIONAL LAB., TENN.
Corrosion of volatility pilot plant hydrofluorinator, 16: 20538 (ORNL-TM-186)
Darex process, 16: 20536 (ORNL-2712)
EQUIPOISE 3A, 16: 20930 (ORNL-3199(Add.))
Ionization produced by α particles in Ar mixtures, 16: 21136 (TID-15708)
Preparation and fabrication of ThO_2 fuels, 16: 20960 (ORNL-3225)
Prog. rpt. on chemical technology, 16: 20537 (ORNL-TM-177)
Prog. rpt. on Eurochemic assistance program, 16: 20539 (ORNL-TM-246)
Program for computing γ transmission through slabs, 16: 20931 (ORNL-TM-167(Rev.))
Radiation measurements by frequency variation, 16: 20644 (TID-15702)
Radiation stability of aqueous thoria, 16: 21095 (ORNL-3274)

OFFICE OF CIVIL AND DEFENSE MOBILIZATION, BATTLE CREEK, MICH.
Plumbbob aerial-monitoring operations, 16: 20647 (WT-1485)

P

PARIS. UNIVERSITÉ.
Prog. rpt. of Linear Accelerator Lab., 16: 21646 (LAL-1010)
Prog. rpt. of Linear Accelerator Lab., 16: 21647 (LAL-1021)

PERU. JUNTA DE CONTROL DE ENERGIA ATOMICA, LIMA.
Reconnaissance for U in Peru, 16: 20818 (RME-4517)
Reconnaissance for U in Peru, 16: 20819 (RME-4521)

PHILLIPS PETROLEUM CO. ATOMIC ENERGY DIV., IDAHO FALLS, IDAHO.
Fuel element flow blockage in ETR, 16: 21719 (IDO-16780)
Prog. rpt. on chemical processing, 16: 20534 (IDO-14574)
Prog. rpt. on chemical processing, 16: 20535 (IDO-14583)
Prog. rpt. on MTR-ETR, 16: 21839 (IDO-16760)
Total neutron cross sections of Pa-231, 16: 21349 (IDO-16698)

PITTSBURGH. UNIV.
Prog. rpt. on rare earth chalcogenides, 16: 21013 (AD-266094)
Prog. rpt. on rare earth chalcogenides, 16: 21014 (AD-266097)

POLISH ACADEMY OF SCIENCES. INST. OF NUCLEAR RESEARCH, KRAKOW.
Attenuation of Ta-181 133-482 kev cascade, 16: 21350 (NP-11602)

POLISH ACADEMY OF SCIENCES. INST. OF NUCLEAR RESEARCH. WARSAW.
Radioactivity of slags used in building materials, 16: 20871 (PAN-269/I-A)

PRATT AND WHITNEY AIRCRAFT DIV., UNITED AIRCRAFT CORP., HARTFORD, CONN.
Hazards summary on laboratory at CANEL, 16: 21725 (PWAC-139)

PUBLIC HEALTH SERVICE, WASHINGTON, D. C.
Radiological Health Data, Vol. 3, No. 2, 16: 20905 (ACCESS-129)
Radiological Health Data, Vol. 3, No. 4, 16: 20906
Radiological Health Data, Vol. 3, No. 5, 16: 20907

Q

QUEEN'S UNIV., BELFAST.
Ionic distributions in exosphere, 16: 21120 (AFCRL-62-294)
Physics of upper atmosphere, 16: 21121 (AFCRL-1062-I)
Physics of upper atmosphere, 16: 21122 (AFCRL-1062-II)

R

REPUBLIC STEEL CORP. TITANIUM RESEARCH LAB., CANTON, OHIO.
Prog. rpt. on producibility of Ti alloys, 16: 21016 (AD-266140)

RESEARCH CHEMICALS. DIV. OF NUCLEAR CORP. OF AMERICA, BURBANK, CALIF.
Prog. rpt. on rare earth intermetallics, 16: 20971 (AD-266150)

RESEARCH CHEMICALS, INC., BURBANK, CALIF.
Prog. rpt. on rare earth chalcogenides, 16: 21015 (AD-266116)

REYNOLDS ELECTRICAL AND ENGINEERING CO., INC. RADIOLOGICAL SAFETY DIV., MERCURY, NEV.
Gnome on-site radiological safety, 16: 20873 (PNE-133F)

RIAS. DIV. OF MARTIN CO., BALTIMORE.
LCAO-SCF molecular orbitals for non-saturated compounds, 16: 20359

(NP-11530)
ROCHESTER, N. Y. UNIV. ATOMIC ENERGY PROJECT.
Radiation-induced regression of Murphy-Sturm lymphosarcoma, 16: 20130 (UR-575)
Thorium inhalation studies, 16: 20876 (UR-605)

S

SAINT LOUIS UNIV.
Solutions of modified Dirac equation, 16: 21261 (AFOSR-TR-60-172)
SANDIA CORP., ALBUQUERQUE, N. MEX.
Cleanroom design, 16: 20874 (SC-4673(RR))
Cratering experiments in desert alluvium, 16: 20049 (SC-4596(RR))
Defining desert environments, 16: 20821 (SC-4853(RR))
Hypersonic plasma generator, 16: 21139 (UNM-TR-EE-73)
SENTRALINSTITUTT FOR INDUSTRIELL FORSKNING, BLINDERN, NORWAY.
Oxidation of Ta, 16: 21021 (ARL-240)
SHELL INTERNATIONAL PETROLEUM CO. LTD., LONDON.
Economics of small nuclear power reactors, 16: 21815 (NP-11706)
SHELL INTERNATIONALE RESEARCH MAATSCHAPPIJ N. V., THE HAGUE.
Economics of small nuclear power reactors, 16: 21815 (NP-11706)
SOCIÉTÉ NATIONALE D'ÉTUDE ET DE CONSTRUCTION DE MOTEURS D'AVIATION, SURESNES, FRANCE.
Influence on burnout flux of vortices induced in boiling water, 16: 20598 (EURAEC-146)
Prog. rpt. on heat transfer in BWR, 16: 21811 (EURAEC-35)
Prog. rpt. on heat transfer in BWR, 16: 20596 (EURAEC-33)
Prog. rpt. on two-phase flows, air–water, 16: 20597 (EURAEC-144)
SPACE TECHNOLOGY LABS., INC., CANOGA PARK, CALIF.
Generation and acceleration of submicron particles, 16: 20567 (NP-11533)
SPACE TECHNOLOGY LABS., INC., LOS ANGELES.
Radiation damage in semiconductors, 16: 21093 (NP-11655)
STANFORD RESEARCH INST., MENLO PARK, CALIF.
Geophysical experiments pertinent to nuclear blackout—final rpt., 16: 20814 (NP-11603)
STEVENS INST. OF TECH., HOBOKEN, N. J.
Capture of particles into stable betatron orbits, 16: 21651 (SIT-P53)
Plasma physics lecture notes. Chap. V., 16: 21667 (TID-15504)
SYRACUSE UNIV., N. Y.
Energy distribution of electrons from ionizing collisions of heavy particles, 16: 21346 (ARL-185)
Prog. rpt. on specific volumes of liquid metals, 16: 21041 (TID-15663)

T

TECHNICAL OPERATIONS, INC., BURLINGTON, MASS.
Monte Carlo calculations on scattered γ radiation, 16: 21693 (NP-11819)
TEXAS. AGRICULTURAL AND MECHANICAL COLL., COLLEGE STATION. ENGINEERING EXPERIMENT STATION.
Survival of rats and mice subjected to radiation, 16: 20130 (NP-11741)
TEXAS. AGRICULTURAL AND MECHANICAL COLL., COLLEGE STATION. RESEARCH FOUNDATION.
Survival of rats and mice subjected to radiation, 16: 20130 (NP-11741)
TEXAS INSTRUMENTS, INC., DALLAS.
Thermoelectric direct-conversion nuclear reactors, 16: 21791 (AD-267442)
TEXAS. UNIV., AUSTIN.
Electron density measurements with Pound system, 16: 21113 (AD-266197)
THERMO ELECTRON ENGINEERING CORP., CAMBRIDGE, MASS.
Solar thermionic power systems, 16: 21849 (WADD-TR-60-698(Pt.I))
THOMPSON RAMO WOOLDRIDGE INC., CLEVELAND.
Solar thermionic power systems, 16: 21849 (WADD-TR-60-698(Pt.I))
TITANIUM METALS CORP. OF AMERICA, TORONTO. OHIO.
Prog. rpt. on Ti sheet rolling program, 16: 21009 (AD-264815)

U

UNION CARBIDE NUCLEAR CO. Y-12 PLANT, OAK RIDGE, TENN.
Program for determining first-collision neutron doses, 16: 20877 (Y-1386)

UNITED KINGDOM ATOMIC ENERGY AUTHORITY. AUTHORITY HEALTH AND SAFETY BRANCH, RISLEY, LANCS, ENGLAND.
Evaluation of power reactor sites, 16: 20865 (DPR/INF/266)
Wood density measurements in criticality clearance of transport containers, 16: 20861 (AHSB(S)R-36)
UNITED KINGDOM ATOMIC ENERGY AUTHORITY. AUTHORITY HEALTH AND SAFETY BRANCH. RADIOLOGICAL PROTECTION DIV., HARWELL, BERKS, ENGLAND.
Radiation protection (reading list), 16: 20859 (AERE-READING-LIST-8)
UNITED KINGDOM ATOMIC ENERGY AUTHORITY. PRODUCTION GROUP. CHEMICAL SERVICES DEPT., WINDSCALE, SELLAFIELD, ENGLAND.
Analysis of seaweed for Ru-106, 16: 20322 (PG-Report-122)
Determination of Ru-103, Ru-106, Cs-137, Zr/Nb-95, and Ce-144, 16: 20323 (PG-Report-312)
UNITED KINGDOM ATOMIC ENERGY AUTHORITY. REACTOR GROUP, RISLEY, LANCS, ENGLAND.
Thermometer for thermocouple calibration, 16: 20646 (TRG-Report-261)
UNITED KINGDOM ATOMIC ENERGY AUTHORITY. REACTOR GROUP, WINDSCALE, CUMB, ENGLAND.
Post-irradiation examination facilities at Windscale Works, 16: 21089 (DPR/INF/265)
UNITED KINGDOM ATOMIC ENERGY AUTHORITY. REACTOR GROUP, ATOMIC ENERGY ESTABLISHMENT, WINFRITH, DORSET, ENGLAND.
Complex frequency testing, 16: 21118 (AEEW-M-220)
Heat diffusion in cylindrical fuel elements, 16: 21712 (AEEW-R-96)
Reactor control studies, 16: 21713 (AEEW-R-121)
Signal-to-noise ratio of transfer function analyzer, 16: 20627 (AEEW-R-132)
Sodium reactivity effects in dilute fast reactor, 16: 21711 (AEEW-M-225)
UNITED KINGDOM ATOMIC ENERGY AUTHORITY. RESEARCH GROUP, ATOMIC ENERGY RESEARCH ESTABLISHMENT, HARWELL, BERKS, ENGLAND.
Scattering law experiment, 16: 21331 (AERE-R-4019)
Scattering of thermal neutrons by moderators, 16: 21332 (AERE-R-4041)
UNITED KINGDOM ATOMIC ENERGY AUTHORITY. RESEARCH GROUP, WANTAGE RESEARCH LAB., WANTAGE, BERKS, ENGLAND.
Decomposition of aqueous targets on pile irradiation, 16: 20466 (AERE-R-3409)
UNITED KINGDOM ATOMIC ENERGY AUTHORITY. WEAPONS GROUP. ATOMIC WEAPONS RESEARCH ESTABLISHMENT, ALDERMASTON, BERKS, ENGLAND.
Light mass yields in neutron fission of U-235, 16: 21347 (AWRE-O-58/61)
UNITED NUCLEAR CORP. CHEMICALS DIV., HEMATITE, MO.
Prog. rpt. on UO_2 powders, 16: 20961 (UNC-1001)
UNITED NUCLEAR CORP. DEVELOPMENT DIV., WHITE PLAINS, N. Y.
Soundness of Cb–1% Zr welds, 16: 20807 (NP-11694)
UNITED STATES. CONGRESS. JOINT COMMITTEE ON ATOMIC ENERGY.
Detection of nuclear explosions, 16: 20854
Detection of nuclear explosions, 16: 20855
UNITED STATES–EURATOM JOINT RESEARCH AND DEVELOPMENT PROGRAM.
Influence on burnout flux of vortices induced in boiling water, 16: 20598 (EURAEC-146)
Prog. rpt. on burnout heat flux with boiling water, 16: 20591 (ATL-A-113)
Prog. rpt. on diffusion of inert gases, 16: 21047 (EURAEC-17)
Prog. rpt. on diffusion of inert gases, 16: 21048 (EURAEC-18)
Prog. rpt. on diffusion of fission gases in nuclear fuels, 16: 21049 (EURAEC-121)
Prog. rpt. on effects of radiation on pressure vessel steels, 16: 21090 (EURAEC-140)
Prog. rpt. on electrochemical transient methods in chemical analysis, 16: 20353 (EURAEC-241)
Prog. rpt. on heat transfer in BWR, 16: 21811 (EURAEC-35)
Prog. rpt. on heat transfer in BWR, 16: 20596 (EURAEC-33)
Prog. rpt. on hot channel and hot spot calculations, 16: 20592 (EURAEC-264)
Prog. rpt. on retreatment of spent fuels, 16: 20541 (EURAEC-24)
Prog. rpt. on sintered UO_2, 16: 21091 (EURAEC-248)
Prog. rpt. on sintering UO_2, 16: 20996 (EURAEC-2)
Prog. rpt. on swaging UO_2, 16: 20997 (EURAEC-10)
Prog. rpt. on two-phase flows, air–water, 16: 20597 (EURAEC-144)

Prog. rpt. on U–UC cermets, 16: 20998 (EURAEC-220)
Prog. rpt. on U–UC cermets, 16: 20999 (EURAEC-247)
Prog. rpt. on UC shaping and irradiation, 16: 20952 (EURAEC-71)
Prog. rpt. on UO_2 fuel systems, 16: 20951 (CEND-149)
Prog. rpt. on Zr alloys, 16: 20973 (ARF-2198-18)
Prog. rpt. on Zr–Nb alloys, 16: 20980 (EURAEC-26)
Prog. rpt. on Zr–Nb alloys, 16: 20981 (EURAEC-27)
Prog. rpt. on Zr–Nb alloys, 16: 20982 (EURAEC-85)

V

VANDERBILT UNIV., NASHVILLE.
Detection of electrons in β spectrometer, 16: 20645 (TID-15742)
Determination of K shell conversion coefficients, 16: 21134 (TID-15639)
Energy dissipation by bremsstrahlung spectrum, 16: 21135 (TID-15706)
Ionization produced by α particles in Ar mixtures, 16: 21136 (TID-15708)
L Auger yields of Hg, 16: 21359 (TID-15692)
Radiation measurements by frequency variation, 16: 20644 (TID-15702)

W

VAN CHANG CORP., ALBANY, ORE.
Prog. rpt. on Ta extrusion, 16: 20992 (ASD-TR-7-783(III))
VATERTOWN ARSENAL, MASS.
Emissivity of graphites at elevated temperatures, 16: 21042 (WAL-TR-851.2/1)
Magnetic and spectroscopic properties of rare-earth ions, 16: 21128 (MRL-118)
VATERWAYS EXPERIMENT STATION, VICKSBURG, MISS.
Grout mixtures for Project Gnome, 16: 20046 (PNE-116F)
WEATHER BUREAU, LAS VEGAS, NEV.
Weather and radiation prediction activities for Gnome, 16: 20817 (PNE-126F)
WESTINGHOUSE ELECTRIC CORP. ATOMIC POWER DEPT., PITTSBURGH.
Prog. rpt. on CVTR Project, 16: 21825 (WCAP-4121)
WESTINGHOUSE ELECTRIC CORP. ATOMIC POWER DIV., PITTSBURGH.
Instrument valves for flow measurement and sampling system, 16: 20631 (CVNA-140)
Reactivity coefficients in UO_2–D_2O two-region lattice, 16: 21716 (CVNA-114)
WESTINGHOUSE ELECTRIC CORP. BETTIS ATOMIC POWER LAB., PITTSBURGH.
Coolant radionuclide base levels for PWR Core I, Seed 2, 16: 21824 (WAPD-PWR-TE-89)
Failed element detection and location system, 16: 21823 (WAPD-PWR-TE-70)
MO150—a FORTRAN program for slab geometry, 16: 20934 (WAPD-TM-315)
Program for calculation of capture probabilities, 16: 20933 (WAPD-TM-273)
WESTINGHOUSE ELECTRIC CORP. RESEARCH LABS., PITTSBURGH.
Prog. rpt. on thermoelectricity, 16: 21012 (AD-265328)
WISCONSIN. UNIV., MADISON.
Hydromagnetic flow with transverse magnetic field, 16: 21117 (AD-269326)
Thermodynamic properties of ions, 16: 20351 (ARL-191)

Y

YALE UNIV., NEW HAVEN.
Oxidation of iron and cobalt, 16: 20360 (NYO-10289)

PERSONAL AUTHOR INDEX

Each entry after an author's name is a shortened version of the title of the report or article, followed by the *NSA* volume and abstract number. Report numbers are given in parentheses.

The phrase "Progress report" is abbreviated as "Prog. rpt." This change permits a more rapid and complete alphabetical arrangement of the titles without changing the location of the progress report titles in relation to the other titles.

Because of problems involving the mechanical preparation of this index, all accent marks are omitted. The following changes in spelling have been introduced to reduce some of the confusion which might result from omitting the accents:

ä	becomes	ae
ö		oe
ø		oe
ü		ue (except in transliterated Chinese names)

A

ABBATTISTA, N., Elastic scattering of $\pi^+ + p$, 16: 21293

ABE, R., Theory of transport coefficients. I., 16: 21166

ABELEDO, D., Binding energy data from hypernuclei, 16: 21490

ACHOR, William T., L Auger yields of Hg, 16: 21359 (TID-15692)

ACTON, Eric William Vickers, Improvements in nuclear reactors, 16: 21767

ACTON, Eric William Vickers, Improvements in fuel elements, 16: 21772

ACTON, Eric William Vickers, Improvements in fuel elements, 16: 21777

ADAMS, B. M., Heavy ion excitation of Pd-108 and Pd-110, 16: 21516

ADAMS, B. M., Oxygen ion excitation in Ru-102, Ru-104, Pd-106, Cd-112, and Cd-114, 16: 21517

ADAMS, J. Barclay, Six nucleon form factors, 16: 21325

ADAMS, Ralph H., Spectrum of N,N'-tetramethylbenzidine, 16: 20419

ADDA, Yves, Diffusion and solubility of Fe in Be, 16: 21054

AEBI, H., Radioinduced formate oxidation, 16: 20485

AEBI, Hugo, Tritium incorporation in cell substances, 16: 20221

AGGSON, T., Ionization by relativistic particles, 16: 21288

AGRAWAL, H. C., Free and forced convection in channels, 16: 20602

AGRINIER, B., Characteristics of the 56 AVP photomultiplier, 16: 20725

AGRINIER, B., Experiments with a spark chamber, 16: 20729

AHLBORN, Hans, Growth and orientation of needle-shaped W crystals, 16: 21083

AHMADZADEH, Akbar, Regge trajectories for single attractive Yukawa potential, 16: 21268 (UCRL-10140)

AIHARA, Shuko, Theta pinch device, 16: 21669

AIZENSHTADT, V. S., Energy and photons in equilibrium emission spectrum, 16: 21225

AJDACIC, V., Distribution of pile-neutron flux, 16: 20754

AKERHIELM, F., Experiments with HBWR first fuel charge, 16: 21813 (HPR-21)

ALBERTI, G., Separation of inorganic ions in fused salts, 16: 20550

ALBERTS, L., Magnetostriction of Dy metal, 16: 21214

ALBOUY, G., Excitation functions for (p,pα) reactions, 16: 21484

ALBOUY, G., Excitation functions for (p,xn) on gold, 16: 21485

ALDER, Kurt, Nuclear moments of excited states, 16: 21446

ALEXANDER, K. F., Activation cross sections of Hf-178m and Hf-179m, 16: 21395

ALEXANDER, P., Cross-linking of DNA to protein, 16: 20198

ALEXANDER, T. K., Coincidence pulse-amplitude analyzer, 16: 20776

ALEXANDER, T. K., Thermal neutron analyzer, 16: 21333 (CRRP-1078)

ALFILLE, Lucien, Improvements relating to reactors, 16: 21759

ALFIMENKOV, V. P., Energy spectrum of resonance absorption of γ rays in Zn-67, 16: 21362 (AEC-tr-5115)

ALFORD, W. L., Neutron partial cross section studies, 16: 21352 (NP-11667)

ALFORD, W. P., Double pick-up of inequivalent nucleons in $C^{14}(d,\alpha)B^{12}$, 16: 21577

ALFORD, W. Parker, Inelastic proton scattering, 16: 21393

ALKSNE, Alberts Y., Effect of ring current on geomagnetic field, 16: 21[illegible]

ALLEMAND, R., Transistorized pulse-height discriminator, 16: 20797

ALLEN, Ralph G., Jr., Problems in shielding, 16: 20241

ALLISON, Marvin J., Biphasic response in resistance to tuberculosis in rabbits, 16: 20068

ALLISON, Samuel K., Stopping power H_2 for charge-invariant atomic projectiles, 16: 21628

ALLSOPP, C. B., Gonad doses received by dental patients, 16: 20884

ALMELEH, L., Shield computer program 18-0, 16: 21691 (DC-60-7-9)

ALMQVIST, E., Deexcitation branching and radiative widths of Ne-20, 16: 21633

ALTINLI, A., Excretion of Na and K after Ra treatment, 16: 20254

ALTMANN, H.-W., Radiation-induced epithelial carcinoma in rat lung. I., 16: 20147

ALTMANN, H.-W., Radiation-induced epithelial carcinoma in rat lung. II., 16: 20148

ALVAGER, T., Deflection method for measuring short half lives, 16: 21438

AMATI, D., Low-energy nucleon-nucleon interaction, 16: 21480

AMBARTSYUMYAN, Ts. L., Thermal studies of U and U-bearing minerals, 16: 20853

AMBROSINO, G., Apparatus for discriminating shapes, 16: 20786

AMER, S., Separation of rare earths, 16: 20543

AMIEL, S., Determination of U in ores, 16: 20328

AMIEL, S., Lithium and Li-6 analysis by counting delayed neutrons, 16: 20318 (IA-690)

AMIN, Hossoh, Hematopoietic function in radiation-induced leukopenia, 16: 20269

AMMAR, R. G., Binding energy data from hypernuclei, 16: 21490

AMOSOV, I. S., Pulmonary blood vessels radiation sickness, 16: 20189

AMRAM, Y., Binary number comparator, 16: 20767

AMRAM, Y., Intermediate arithmetic memory, 16: 20768

AMRAM, Y., Two-dimensional selector type 2X3, 16: 20765

ANDERKO, K., Constitution of Zr–Nb alloys, 16: 21061

ANDERKO, K., Prog. rpt. on Zr–Nb alloys, 16: 20980 (EURAEC-26)

ANDERKO, K., Prog. rpt. on Zr–Nb alloys, 16: 20981 (EURAEC-27)

ANDERKO, K., Prog. rpt. on Zr–Nb alloys, 16: 20982 (EURAEC-85)

ANDERLE, H. T., Prog. rpt. on radiacmeter research, 16: 20625 (AD-265927)

ANDERSON, C. E., Heavy-ion-induced fragmentation studies, 16: 21634

ANDERSON, E., Prog. rpt. on effects of radiation on pressure vessel steels, 16: 21090 (EURAEC-140)

ANDERSON, F. D., Calculation of distance factors for reactor sites,

16: 21726 (TID-14844)
ANDERSON, F. H., Gravimetric factors for U, 16: 20319 (K-1476(Rev.1))
ANDERSON, H. L., Spark chamber for meson decay, 16: 20732
ANDERSON, Jess, PARMESH dynamics program-III, 16: 20929 (MURA-635)
ANDERSON, John E., Plasma torch chemistry, 16: 20391
ANDERSON, K. A., Solar flare x-ray burst, Sept. 1961, 16: 21238 (NP-11658)
ANDERSON, Roy S., Radiation damage in dl-aspartic acid, 16: 20496
ANDERSON, S. L., Gamma transitions in S-32, 16: 21497
ANDERSON, W. J., Behavior of materials through stress-strain relationships, 16: 20806 (NAA-SR-6376)
ANDO, Wataru, Radiation reaction of Si hydride, 16: 20478
ANDREEVA, I. V., Salts of uranyl interaction with vegetable tissue, 16: 20090
ANDREEV, P. F., Salts of uranyl interaction with vegetable tissue, 16: 20090
ANDREW, J. F., Prog. rpt. on properties of carbons and graphites, 16: 21038 (NP-11665)
ANDRIAN, T., Influence of radiation on treatment of trypanosomiasis, 16: 20256
ANDRIEUX, H., Single-channel transistorized selector, 16: 20790
ANGELO, Pisani, Radiation effects on vegetable mitosis, 16: 20212
ANGELOPOULOS, M., Flux distribution in subcritical piles, 16: 21730
ANGINO, Ernest E., Bibliography on thermoluminescence, 16: 21133 (TID-3811)
ANGOSO, M., Separation of rare earths, 16: 20543
ANKI, Shigeboni, Temperature and heat distribution in fuel elements, 16: 20600
APANASEVICH, P. A., Energy and photons in equilibrium emission spectrum, 16: 21225
APELGOT, S., Radiochemical investigation of nucleic acids, 16: 20515
APODACA, D. R., Effect of thermal histories on material strength, 16: 21023 (ASD-TR-61-194)
APPELMAN, A. W. M., Irradiation effects on DNA, 16: 20193
APRAKSIN, I. A., Extraction of Zr and Hf, 16: 20545
ARBEL, A. F., Converter for pulse-height analysis, 16: 20758
ARBITER, William, Soundness of Cb–1% Zr welds, 16: 20807 (NP-11694)
ARBUZOV, B. A., Scattering of Λ and K_1^0 on H_2, 16: 21264 (JINR-D-820)
ARCHER, Victor E., Hazards to health in U mining and milling, 16: 20893
ARIFOV, U. A., Secondary emission from Mo, 16: 21156
ARIANI, Roland J., Argonne Thermal Source Reactor, 16: 21714 (ANL-6441)
ARNDT, E. J., Prog. rpt. on high-purity Be, 16: 20958 (NP-11702)
ARNOLD, E. D., Preparation and fabrication of ThO_2 fuels, 16: 20960 (ORNL-3225)
ARO, F., Alpha decay scheme of Am-242m, 16: 21518
ASHBURY, A., Nuclear capture of polarized muons, 16: 21426
ASTROEM, B., Instrumentation for pulse spectroscopy, 16: 20753
ATHAY, R. Grant, Energies of solar origin, 16: 20231
ATKINSON, L. F., Radioisotope displacement transducers, 16: 20913
AUKLAND, Morrill F., Bibliography on plasma physics and MHD, 16: 21660 (AD-271170)
AUSTERN, N., Distorted-waves calculation of direct reactions, 16: 21579
AUSTIN, S. M., Reactions (n,np), (p,pn), and (p,2p) on C-12, 16: 21466
AVANZINI, Sergio, Modification of neoplastic cells with Au-198, 16: 20141
AZOU, P., Comparison of H–Hf and H–Zr systems, 16: 21064
AZUMA, T., Distribution and leakage of γ-rays, 16: 20881
AZUMA, Toshio, Measurement of Cs-137 concentration, 16: 20123
AZUMA, Toshio, Observation of fall-out, 16: 20121
AZUMA, Toshio, Radioactive air-borne dusts, 16: 20122
AZUMA, Toshio, Radioactivation of In-115, 16: 21366

B

BABAYAN, C. P., Ionization pulses of cosmic radiation, 16: 21249
BABESHKIN, A. M., Migration of radioactive isotopes produced in α decay, 16: 20373 (AEC-tr-4457(p.281-93))
BABINI, L., Chemical protection in radioinduced lesions, 16: 20219
BACHMANN, D., Cardio-radiological diagnosis, 16: 20089
BACON, G. E., Magnetic structure of AuMn, 16: 21213
BACQ, Z. M., Action of x radiation on adrenergic transmission, 16: 20143
BADITIOU, I., Influence of radiation on treatment of trypanosomiasis, 16: 20256
BAGNALL, K. W., Uranium(IV) perchlorate, 16: 20420
BAGNALL, Kenneth Winfield, Equipment for handling dangerous substances, 16: 20585
BAILEY, A. J., Effect of irradiation on collagen, 16: 20182
BAILEY, R. A., Chromatographic and electromigration techniques in radiochemistry, 16: 20469 (NAS-NS-3106)
BAINBRIDGE, A. E., Tritium content of meteorites, 16: 20827
BAKER, L., Reactor safety, 16: 20300 (ANL-6477(p.168-203))
BAKER, R. E., Calculation of distance factors for reactor sites, 16: 21726 (TID-14844)
BALACHANDRAN, A. P., Low-energy K^+-nucleon scattering, 16: 21296
BALASHEV, Yu. A., Rare earths in Ural peridotite, 16: 20835
BALDIN, S. A., Gaseous scintillation counter, 16: 20710
BALEZIN, S. A., Atmospheric corrosion of "ARMCO" steel and carbon steel, 16: 21098
BALL, J. B., Nuclear distortion in the Fe region, 16: 21565
BALL, J. B., Pickup reaction studies of Fe-54 and Co-59, 16: 21563
BALL, J. B., Pickup reaction evidence for deformation of Fe-56, Fe-57, and Fe-58, 16: 21564
BALL, R. M., CETR core assembly physics and zero power tests, 16: 21795 (BAW-163)
BALL, R. M., Enriched UO_2 cores studied for NMSR, 16: 21257 (BAW-1216)
BALL, W. C., Jr., Regional pulmonary function studied with Xe-133, 16: 20065
BALLARD, L. F., Flexible Geiger counters, 16: 20740
BALLOFFET, Germaine, Emission source for continuous spectra, 16: 20448
BALTASAR, Benjamin, Tagged red cell studies. I., 16: 20055
BALTASAR, Benjamin, Tagged red cell studies. II., 16: 20056
BALZHISER, Richard E., Uranium–Bi system, 16: 21071
BAMAUGH, Robert P., Scattering of acoustic and elastic waves by surfaces of arbitrary shape, 16: 21137 (UCRL-6779)
BANDIRALI, G. R., Liquid diffusion in skin of irradiated animals, 16: 20213
BANERJEE, B., Energy levels of iodine isotopes, 16: 21525
BANKOFF, S. G., Jet intruding into boiling stream, 16: 20616
BARABASCHI, S., Design for reactor safety systems, 16: 21724 (NP-11701)
BARAN, Walter J., Isotopic exchange of D, 16: 20923 (NP-11789)
BARANOV, V. I., Migration of radioactive isotopes produced in α decay, 16: 20373 (AEC-tr-4457(p.281-93))
BARANOW, S., Coated refractory metal, 16: 21031 (DC-60-8-25)
BARB, D., Distillation of isotopic mixtures in tapered conditions, 16: 20922 (IFA/DF/15)
BARBARO-GALTIERI, A., Proton-nucleon collisions, 16: 21286
BARBER, Barry, Guarded-field thimble ionization chamber, 16: 20686
BARBER, W. C., Inelastic electron scattering from the deuteron, 16: 21640
BARENDSEN, G. W., Irradiation effects on DNA, 16: 20193
BARJON, R., Time-of-flight spectrometry of neutrons scattered by C, 16: 21378
BARKAS, W. H., Grain density of emulsion tracks, 16: 20677
BARNARD, D., Oxidation of organic sulfides. XI., 16: 20499
BARNETT, D. E., Gamma irradiation of turbojet accessory systems, 16: 21096 (XDC-60-2-116)
BARON, Samuel, Antibody in recovery from infection with vaccinia virus, 16: 20270
BARONI, E. E., Plastic scintillators, 16: 20717
BARONI, G., Proton-nucleon collisions, 16: 21286
BARROW, H., Turbulent gas flow between walls, 16: 20604
BARRY, J. F., Neutrons from reactions between H-3 and He-3, 16: 21573
BARRY, P. J., Dilution rate factors from reactor stack, 16: 20858 (AECL-1518)
BARSELLA, B., Relativistic three-body systems, 16: 21704
BARTALOS, Mihely, Effect of radiation on serum activity level, 16: 20258
BARTECKI, A., Absorption spectra of uranyl compounds, 16: 20449
BARTHOLOMEW, G. A., Neutron capture transitions, 16: 21454
BARTLEY, J. H., Nuclear capture of polarized muons, 16: 21426
BARTOLOMEI, George G., Nuclear light source material, 16: 20583
BARUT, A. O., Analyticity in complex angular momentum of S matrix,

16: 21698 (AFOSR-2400)
BASALOVA, G. I., Thermal studies of U and U-bearing minerals, 16: 20853
BASHANDY, E., Absorption coefficients of γ rays, 16: 21695
BASHANDY, E., Shielding properties of concrete, 16: 21694
BASKIN, Y., Sintering study of thoria, 16: 20529
BASSI, P., Reaction $Be^9(n,\alpha)He^6$, 16: 21401
BASTIEN, P., Comparison of H–Hf and H–Zr systems, 16: 21064
BASTIEN, P., Glide elements of Be deformation, 16: 21045 (AEC-tr-5138)
BATCHELOR, R., Neutrons from reactions between H-3 and He-3, 16: 21573
BATES, D. R., Charge transfer, 16: 21273
BATES, D. R., Physics of upper atmosphere, 16: 21121 (AFCRL-1062-I)
BATES, D. R., Recombination between electrons and ions. I., 16: 21683
BATES, D. V., Regional pulmonary function studied with Xe-133, 16: 20065
BATES, T. H., Radiation chemistry of α-pinene, 16: 20497
BATES, T. H., Radiation chemistry of β-pinene, 16: 20498
BATTY, C. J., Solid-state ionization chamber, 16: 20749
BATTY, J. V., Radioactive tracers in Be metallurgy, 16: 20950 (BM-RI-5980)
BAUDINET-ROBINET, Y., Proton-nucleon collisions, 16: 21286
BAUER, Goeron C. H., Uptake of Sr-85 in man, 16: 20081
BAUER, R., Spleen and bone marrow in radiation reactions, 16: 20262
BAUER, R. W., Nuclear g values of states of Sm-152, Gd-154, and Gd-156, 16: 21505
BAUER, S. J., Upper atmosphere temperatures, 16: 21227
BAUMINGER, R., Nuclear moments of states of Dy-161, 16: 21526
BAUR, Walter, Cost calculation in nuclear power stations. IV., 16: 21828
BAXTER, W. G., Gamma irradiation of turbojet accessory systems, 16: 21096 (XDC-60-2-116)
BAYADSYAN, N. G., Ionization pulses of cosmic radiation, 16: 21249
BAYER, R., Amplitude ratio of two pulses, 16: 20791
BAYMAN, B. F., Reaction (p,α) and seniority in the $f_{7/2}$ shell, 16: 21578
BAZAROV, I. P., Theory of the crystal, 16: 21204
BEALI E. F., Polarization in π^--p scattering, 16: 21323
BEATON, Leonard, Tactical nuclear weapons, 16: 20051
BEAUMARIAGE, M. L., Action of x radiation on adrenergic transmission, 16: 20143
BECAREVIC, A., Recovery effect of liver DNA injected into irradiated rats, 16: 20283
BECK, Francis, Plane polarization of AcC'' γ rays, 16: 21369
BECKER, Erwin Willy Albert, Production of deuterium, 16: 20927
BECKER, K., Practical film dosimetry, 16: 20879 (NP-tr-904)
BECKER, S. J., Strain hardening in yielded compound cylinder, 16: 20965
BEEKHUIS, H., Calibrating and testing pulse-height converters, 16: 21439
BEETS, C., Spectral analysis of fast neutrons, 16: 21338
BEGHIN, A., Prog. rpt. on two-phase flows, air–water, 16: 20597 (EURAEC-144)
BEGUN, G. M., Spectra of trifluoride-dimethyl ether complex, 16: 20445
BELL, Friedhelm, Recovery and recrystallization of Ni, 16: 21082
BELL, J. S., Electromagnetic properties of unstable particles, 16: 21301
BELL, J. S., Noncovariant electrodynamics, 16: 21700
BELL, J. S., The many-body problem, 16: 21530
BELLIER, Jean, Improvements in reactors, 16: 21766
BELLINI, F., Radiation dose in heart x-ray investigation, 16: 20888
BELOUSOVA, I. M., Natural radioactivity, 16: 20229
BELOV, N. V., Crystal structure of $(RbBe_3F_4)$, 16: 20440
BELOV, N. V., Crystal structure of $Pr(NO_3)_3 \cdot 6H_2O$, 16: 20443
BELOVA, Z. M., Metabolic rate of K and Na erythrocytes, 16: 20101
BEL'SKII, N. K., Double refraction in $EuCl_3 \cdot 6H_2O$, 16: 20386
BENDALL, J. R., Effect of irradiation on collagen, 16: 20182
BENDER, Merrill A., Visualization of the pancreas by isotope scanning, 16: 20114
BENDINELLI, Ralph A., Grout mixtures for Project Gnome, 16: 20046 (PNE-116F)
BENES, S., Radiation in infection with pathogenic *staphylococci*, 16: 20257
BENINSON, D., Radiocesium in human diet, 16: 20856 (A/AC.82/G/L.746)
BEN-ISHAI, Ruth, Effect of uv irradiation on bacteria, 16: 20149
BENNETT, W. R., Jr., Optical spectra in noble gases, 16: 21147
BENOIST, P., Emission of deuterons and tritons and correlations in nuclei, 16: 21488
BENTLEY, R. E., Fission products in drinking waters, 16: 20126
BEREZHNOI, A. S., System $CaO–MgO–ZrO_2–SiO_2$, 16: 21067
BEREZINA, O. N., Effects of radiation on virus immunity, 16: 20227
BERGER, Harold, Neutron radiography, 16: 20810
BERGHEIM, K., Gas scintillation counter, 16: 20715
BERGLUND, S., Probes for plasma research, 16: 20661
BERGMANN, W., Numerical solution of two-group diffusion equations, 16: 21341
BERGSTROEM, R. M., Skin of the frog after irradiation, 16: 20134
BERK, Sigmund, Radioisotope methods for measuring weight, 16: 20917
BERKHOVSKIKH, S. M., Effect of radiation on metal oxide films, 16: 21[illegible]
BERKOWITZ, J., Heat of formation of CN radical, 16: 20405
BERKOWITZ, Joan, Materials for vacuum insulation, 16: 20590 (ASD-TDR-62-88)
BERNARD, B., Prog. rpt. on two-phase flows, air–water, 16: 20597 (EURAEC-144)
BERNARD, Jean Louis, Determining thermal stresses, 16: 20811
BERNSTEIN, E. M., Lifetimes by Coulomb excitation, 16: 21444
BERRY, H. W., Energy distribution of electrons from ionizing collisions of heavy particles, 16: 21346 (ARL-185)
BERTANZA, L., Recoil proton in $\gamma + p \rightarrow p + \pi^0$, 16: 21311
BERTHIER, Gaston, LCAO-SCF molecular orbitals for non-saturated compounds, 16: 20359 (NP-11530)
BERTINCHAMPS, A. J., ESR in irradiated DNA, 16: 20195
BERTOLINI, G. C., Reaction $Be^9(n,\alpha)He^6$, 16: 21401
BERTRAND, J., Delayed neutrons in "Proserpine", 16: 21739
BESSMAN, Maurice J., Kinetics of parental DNA replication in *E. coli*, 16: 20095
BEST, J. V. F., Radiation chemistry of α-pinene, 16: 20497
BEST, J. V. F., Radiation chemistry of β-pinene, 16: 20498
BETT, F. L., Industrial radiography, 16: 20911
BEYERMANN, K., Roentgenofluorimetric determination of inorganic constituents. I., 16: 20097
BEYERMANN, K., Roentgenofluorimetric determination of inorganic constituents. II., 16: 20098
BHATTACHARYA, P. C., Extensive air showers in air, 16: 21251
BIALECKI, Andrzej, Gyroscopic effect of orbital motion of elementary particles, 16: 21269 (FTD-TT-61-23)
BIDAN, U., Elastic scattering of $\pi^+ + p$, 16: 21293
BIEHL, Arthur Trew, Low power nuclear reactors, 16: 21843
BIELIG, Hans-Joachim, Uptake of V in *Ciona intestinalis*, 16: 20119
BIERLEIN, T. K., Microstructure of U, 16: 20953 (HW-73476)
BIGELEISEN, Jacob, Dehydration of formic acid, 16: 20398
BIGELOW, John E., Multicomponent cascade theory, 16: 20924 (TID-15054)
BILANIUK, O. M., Double pick-up of inequivalent nucleons in $C^{14}(d,\alpha)B^{12}$, 16: 21577
BINCER, A., Relativistic quantum mechanics lectures, 16: 21699 (CERN-62-15)
BINNS, D. F., Irradiation of small sphere gaps, 16: 20571
BIONDI, L., Measuring burnup of fuel, 16: 21734
BIOT, M. A., Sturm-Liouville equation, 16: 20942
BIRK, M., Transistor-driven decade counter tubes, 16: 20801
BIRKS, J. B., Organic scintillation detectors, 16: 20708
BIRKS, J. B., Proceedings of Rutherford jubilee conference, Manchester, 1961, 16: 21462
BISHOP, G. R., Electro- and photodisintegration of O-16, 16: 21377
BISHOP, R. H., Cratering experiments in desert alluvium, 16: 20049 (SC-4596(RR))
BLACKBURN, George, Improvements in valved ducting, 16: 20621
BLAIR, I. M., Nuclear capture of polarized muons, 16: 21426
BLAISSE, B. S., Properties of Nd Mg nitrate, 16: 20438
BLANC, A., Windowless photomultipliers, 16: 20724
BLANC, D., Performance of ionization chambers, 16: 20734
BLANC, D., Radon and thoron in the atmosphere, 16: 20848
BLANC, D., Sphere-plane type spark counters, 16: 20738
BLANCO, R. E., Prog. rpt. on chemical technology, 16: 20537 (ORNL-TM-177)
BLASER, R. U., Corrosion of C and low alloy steels, 16: 20976 (BW-387)
BLAU, Monte, Visualization of the pancreas by isotope scanning,

16: 20114
BLAVE, A., Losses due to dead time of detectors, 16: 20792
BLIN-STOYLE, R. J., Beta decay of RaE, 16: 21412
BLIN-STOYLE, R. J., Mesonic and other corrections in β decay, 16: 21607
BLOCKLEY, Gwillym John, Improvements in reactors, 16: 21768
BLOOM, S., Direct reactions via single particle modes, 16: 21266 (NP-11680)
BLOOM, Stewart D., Isospin conservation and β-γ circular polarization, 16: 21616
BLOOM, Stewart D., Reactions (p,n) in mirror nuclei, 16: 21582
BLOSS, W., Direct transformation of thermal energy to electrical energy, 16: 21140 (AEC-tr-5048)
BOHMER, A. R., Binding energies of λ particles, 16: 21470
BOECKER, Bruce B., Thorium inhalation studies, 16: 20876 (UR-605)
BOEHM, F., Beta decay of Rb-86, 16: 21409
BOEHM, F., Diffraction monochromator for study of nuclear resonance excitation, 16: 21443
BOESCH, R., Photoneutrons from Be-9, 16: 21410
BOESCHE, H., Iron filters in x-ray diagnosis, 16: 20086
BOESWIRTH, L., Thermal stresses in reactor pressure vessels, 16: 21729
BOGDANKEVICH, O. V., Inelastic nuclear scattering of photons, 16: 21641
BOHMANN, Marion, Radiation damage, 16: 21085
BOHNDORF, W., Film photographic techniques, 16: 20087
BOHNDORF, W., Telecobalt field control, 16: 20088
BOHR, A., Nuclear models—selected topics concerning nuclear spectra, 16: 21621
BOLEY, Bruno A., Integral-transform solutions, 16: 20947
BOLLMANN, W., Prog. rpt. on effects of radiation on pressure vessel steels, 16: 21090 (EURAEC-140)
BOLSTERLI, M., Pairing forces near closed shells, 16: 21509
BONARD, R. T., Ionization chamber for α-particle analysis, 16: 20643 (NP-11691)
BONAZZOLA, G., Operation of electrostatic neutron source, 16: 21657
BONGERS, Leonard H., Radiation tolerances in photosynthesis, 16: 20238
BONNAFOUS, M., Radon and thoron in the atmosphere, 16: 20848
BONNER, T. W., Mechanism of reaction $C^{13}(He^3,n)^{15}$, 16: 21551
BONSE, G., Telecobalt field control, 16: 20088
BOOSS, Hans-Juergen, Vickers hardness of Mo and W, 16: 21080
BORCHERS, H. J., Algebra of field operators, 16: 21173
BORISOV, M., Cadmium-sulfide crystal counters, 16: 20742
BORISOVA, I. I., Effect of radiation on metal oxide films, 16: 21108
BORMANN, M., Interaction effects in (n,p) and (n,α) reactions in CsI, 16: 21552
BOSWORTH, R. C. L., Stability in chain reactions, 16: 21259
BOTS, G. J. C., Properties of Nd Mg n trate, 16: 20438
BOTTINO, A., Holomorphy domain of S matrix, 16: 21295
BOTVINKIN, O. K., Effect of radiation on semiconductor films, 16: 21107
BOUCHIAT, Claude C., $\Delta T = 0$ isotopic selection rule in Fermi transactions, 16: 21618
BOUDOURIS, Georges, Nuclear quadrupole resonance and its application, 16: 21169
BOULENGER, R., Prog. rpt. on fall-out at Mol, 16: 20812 (A/AC.82/G/L.711)
BOULENGER, R., Prog. rpt. on fall-out at Mol, 16: 20813 (A/AC.82/G/L.721)
BOULWARE, David G., Gauge invariance and mass, 16: 21324
BOURDEAU, R. E., Upper atmosphere temperatures, 16: 21227
BOURNE, J. G., Prog. rpt. on flow balancing device in BWR, 16: 21820 (TID-15436)
BOURNE, James G., Design of fuel assembly flow control, 16: 21727 (TID-15473)
BOUTEN, M., Copper isotopes by the unified model, 16: 21397
BOUVILLE, A., Radon and thoron in the atmosphere, 16: 20848
BOVEY, L., Spectroscopic studies, 16: 21684
BOVEN, Russell J., Space environment and its interactions with propellants, 16: 21845 (AD-266034)
BOYER, J. R., Prog. rpt. on chemical processing, 16: 20534 (IDO-14574)
BOYER, J. R., Prog. rpt. on chemical processing, 16: 20535 (IDO-14583)
BOYARSKI, A., Hodoscope performance and design, 16: 20772
BOYER, J., Performance of ionization chambers, 16: 20734
BOZEK, E., Attenuation of Ta-181 133-482 kev cascade, 16: 21350 (NP-11602)
BOZEK, E., g-Factor of state of Ta-181, 16: 21414
BRABEN, D. T., Energy levels of Na-23, 16: 21498
BRADLEY, Herman, Improvements in nuclear reactors, 16: 21757
BRADLEY, Herman, Improvements in reactor systems, 16: 21835
BRADY, F. P., Reaction (p,α) and seniority in the $f_{7/2}$ shell, 16: 21578
BRAEUNLICH, P., Dosimetry with LiF, 16: 21171
BRAFMAN, H., Transistor-driven decade counter tubes, 16: 20801
BRAID, T. H., Angular correlations in scattering of protons from Mg-24, 16: 21561
BRAID, T. H., Reaction (d,He^3) near Z = 28, 16: 21562
BRAID, T. H., Scattering of α particles by Ni-58 and Ni-60, 16: 21421
BRAID, T. H., Scattering of 43-Mev α particles in the Ni region, 16: 21560
BRAID, T. H., Solid-state detectors, 16: 20747
BRAND, Harry R., Nuclear fuel element, 16: 21004
BRAND, J. A., Tungsten–carbon equilibrium system, 16: 21022 (ASD-TDR-62-25(Pt.I))
BRANDT, B., Analyzer with high time resolution, 16: 20775
BRANNEN, E., Surface dose measurements, 16: 20688
BRAUEN, Wolfgang, Nuclear reactor plant, 16: 21838
BRAUER, G., Cerium oxides. V., 16: 20363 (NP-tr-893)
BRAUN, H., Adrenalin systems of rats after x irradiation, 16: 20173
BRAUNER, Joseph W., Pressure dependence of fluorescence spectra. III., 16: 20406
BREIT, G., Nucleon-nucleon interaction, 16: 21473
BREIT, G., Theory of transfer reactions, 16: 21555
BREKKEN, T., Ion chamber calibration and endurance test, 16: 20648 (XDCL-59-2-722)
BRENNER, M., Gamma-γ directional correlations in Pb-208, 16: 21635
BRESLAUER, S. K., Absorption cross section of stable, low cross section fission products, 16: 21361 (XDC-60-1-141)
BRESLAUER, S. K., Isotopic history trace, 16: 20935 (XDC-60-3-211)
BRICKLEY, S. G., Formation of $UC_{1-x}O_x$, 16: 21050 (NP-tr-901)
BRILLA, G., Retraction acceleration after x irradiation, 16: 20205
BRINCKMANN, H. F., Activation cross sections of Hf-178m and Hf-179m, 16: 21395
BRISSAUD, I., Emission of deuterons and tritons and correlations in nuclei, 16: 21488
BRODA, E., Filling gas for counters, 16: 20668
BRODER, D. L., Biological protection against radiations, 16: 21696
BRODSKII, A. M., Transfer of energy in radiolysis, 16: 20491
BROEK, H. W., Reaction (d,He^3) near Z = 28, 16: 21562
BROEK, H. W., Scattering of α particles by Ni-58 and Ni-60, 16: 21421
BROEK, H. W., Scattering of 43-Mev α particles in the Ni region, 16: 21560
BROGAN, T. R., Magnetohydrodynamic generator, 16: 21847 (AFOSR-2352)
BROMLEY, D. A., Heavy-ion-induced fragmentation studies, 16: 21634
BROMLEY, D. A., Reactions $Li^6(Li^6,d)B^{10}$ and $Li^6(Li^6,t)B^{10}$, 16: 21598
BROOKE, Marcus S., Effect of x irradiation on rejection of skin grafts, 16: 20276
BROVCHENKO, V. G., Neutron scintillation counter, 16: 20787
BROVETTO, P., Operation of electrostatic neutron source, 16: 21657
BROWN, C. L., Nuclear safety specs. for enriched fuel elements, 16: 20867 (HW-70351(Rev.))
BROWN, D., Uranium(IV) perchlorate, 16: 20420
BROWN, G. E., Theory of collective oscillations, 16: 21493
BROWN, Gordon, Improvements in reactors, 16: 21745
BROWN, Henry, Localization of gastrointestinal hemorrhage, 16: 20058
BROWN, J. A. H., Rejection of skin grafts by normal and x-irradiated mice, 16: 20267
BROWN, J. E., Viewing studies for remote handling, 16: 20562 (DC-60-8-32)
BROWN, James Barrett, Repair of x-ray burns, 16: 20136
BROWN, Julie, Localization of gastrointestinal hemorrhage, 16: 20058
BROWN, Lawrence J., Reconnaissance for U in Peru, 16: 20818 (RME-4517)
BROWN, Lawrence J., Reconnaissance for U in Peru, 16: 20819 (RME-4521)
BROWN, Patrick, Prog. rpt. on specific volumes of liquid metals, 16: 21041 (TID-15663)
BROWN, Robert M., Radioactive wastes in marine environment, 16: 20082

BROWN, Sidney O., Effect of irradiation on healing of wounds in albino rat, 16: 20289
BROWN, Sidney O., Survival of rats and mice subjected to radiation, 16: 20130 (NP-11741)
BROWN, W. S., Momentum-space vertex function, 16: 20937
BROWNFIELD, C. D., Effect of thermal histories on material strength, 16: 21023 (ASD-TR-61-194)
BRUCE, H. D., Thermal protection by window glass, 16: 20860 (AFSWP-792)
BRUCE, Marjory, Corrected dimensions for MRC accelerator, 16: 21643 (AERE-Memo-G/M-37)
BRUCKER, G., Capture of particles into stable betatron orbits, 16: 21651 (SIT-P53)
BRUECKMANN, R. E., Charge-storage techniques, 16: 20760
BRUECKNER, Keith A., Momentum distribution in the nucleus, 16: 21531
BRUEGGEMANN, Johannes, Radiation effects on cellulose decomposition, 16: 20206
BRUN, C., Excitation functions in Pa nuclei, 16: 21375
BRUNNER, G., Evaluation of γ scintillation spectrograms. II., 16: 20655
BRYAN, J. G., Approach to nuclear design, 16: 21833
BRYANT, Jack, Electrical counting circuits, 16: 20696
BRYSK, Henry, New scattering approximation, 16: 21706
BUCHANAN, R. A., Infrared-absorption spectra of LiOH and LiOD, 16: 20409
BUCK, B., Scattering of neutrons by nuclei, 16: 21390
BUCLIN, J. P., Halden Reactor Project, 16: 21830
BUCUR, R., Distillation of isotopic mixtures in tapered conditions, 16: 20922 (IFA/DF/15)
BUECHER, W. W., Analysis of the $l_n = 1$ groups in $Cl^{34}(d,p)Cl^{36}$, 16: 21594
BUFFINGTON, A., Cylindrical spark counter, 16: 20731
BUIJZE, C., Packing of liquids for irradiation, 16: 20574
BUJA, Z., Ionization pulses of cosmic radiation, 16: 21249
BUKHSH, M. Nabi, Radioactivity of greensand, 16: 20849
BULL, R. M., Analysis of flash tube data, 16: 20679
BULL, R. M., Design of flash tube arrays, 16: 20680
BUNYAN, P. J., Carbon–C elastic scattering, 16: 21368
BURGE, E. J., Theoretical investigation of slit scattering, 16: 21639
BURGER, Tibor, Blood volume in polycythemia vera and treatment with P-32, 16: 20117
BURGUS, W. H., Total neutron cross sections of Pa-231, 16: 21349 (IDO-16698)
BURK, Maksymilian, Thermal expansion of ceramic materials, 16: 21057
BURKE, J. E., Progress in ceramic science. II., 16: 21084
BURKE, Phillip G., Regge trajectories for single attractive Yukawa potential, 16: 21268 (UCRL-10140)
BURKHARDT, Winston, Hydrogen reduction of U oxides, 16: 20528
BURKHART, L. E., Packing in a Scheibel extractor, 16: 20547
BURLESON, G. R., Cherenkov image detectors, 16: 20723
BURLESON, G. R., Spark chamber spectrometer, 16: 20730
BURLIN, T. E., Validity of cavity ionization theory, 16: 20657
BURNS, David L., Leakage of water from pump seals, 16: 20564 (DP-666)
BURNS, W. G., Decomposition of aromatic substances by radiation, 16: 20517
BURRIS, L., Jr., Chemical-metallurgical processing, 16: 20297 (ANL-6477(p.29-105))
BURROWS, H. C., Jr., Image-intensifier system, 16: 20720
BURTON, R. J., Cratering experiments in desert alluvium, 16: 20049 (SC-4596(RR))
BUSCH, G., Identification of B on Si, 16: 20346
BUSHMAN, Robert S., Study of seeded plasma, 16: 21663 (ARL-62-310)
BUSSETTI, G., Frequency of chemical elements, 16: 21226 (UCRL-Trans-804(L))
BUSSIERE DE NERCY, A., Resonant scattering of γ rays in giant resonance region, 16: 21456
BUSTAD, L. K., Dosimetry of Cs-137 in sheep, 16: 20105
BUTLER, G. C., Dilution rate factors from reactor stack, 16: 20858 (AECL-1518)
BUTLER, J. R., Tantalum in the granite G-1, 16: 20832
BUTTERFIELD, A. J., Stress oxidation of Ni–Cr fuel elements, 16: 21028 (DC-60-1-108)
BUZZELL, Anne, Effect of uv irradiation on nucleic acid, 16: 20150
BYAKOV, V. M., Recombination of radicals under radiolysis, 16: 20521
BYER, J., Prog. rpt. on radiacmeter research, 16: 20625 (AD-265927)

C

CABELL, M. J., Ratio of neutron capture-to-fission for U-233, 16: 21372
CACHON, P., Local characteristics of photomultipliers, 16: 20728
CAGLIOTI, G., Crystal spectrometer, 16: 20678
CAIRNS, John, Length of DNA molecule of T2 bacteriophage, 16: 20096
CALDWELL, D. O., Image-intensifier system, 16: 20720
CALDWELL, Roger Dale, Radiation polymerization, 16: 20523
CALVERT, J. M., Distorted wave effects in stripping, 16: 21587
CALVIN, Melvin, Primordial organic chemistry. I., 16: 20495
CAMAC, M., Infrared heat transfer gage, 16: 20589 (AFCRL-942)
CAMBOU, F., Apparatus for discriminating shapes, 16: 20786
CAMERON, A. G. W., Star formation in elliptical galaxies, 16: 21235
CAMERON, J. F., Performance of scintillation counters, 16: 20714
CAMERON, John, Localization of gastrointestinal hemorrhage, 16: 20058
CAMERON, L. M., Reactions $Li^6(t,d)Li^7$ and $B^{10}(t,d)B^{11}$, 16: 21567
CAMERON, L. M., Reaction $C^{13}(t,\alpha)B^{12}$, 16: 21569
CAMERON, L. M., Reaction $Li^7(t,\alpha)He^4$, 16: 21570
CAMMARANO, Piero, Hepatoma cells following x ray, 16: 20194
CAMPAN, J. L., Spectral analysis of fast neutrons, 16: 21338
CAMPBELL, L. J., Scattering of high-energy deuterons from nuclei, 16: 21467
CAMPBELL, Paul A., Symposium on the energies of space, 16: 20230
CAMPOS, Paulo C., Tagged red cell studies. I., 16: 20055
CAMPOS, Paulo C., Tagged red cell studies. II., 16: 20056
CANFIELD, E. H., Neutron leakage and N_2 abundance of Venus, 16: 21231
CANNON, G. A., Program for multiple lethargy level cell corrections for slab cells, 16: 21721 (MND-C-2500-2)
CANTWELL, R. M., MO150— a FORTRAN program for slab geometry, 16: 20934 (WAPD-TM-315)
CAPP, M. Paul, Radiation exposure in children, 16: 20890
CAPPELLANI, F., Reaction $Be^9(n,\alpha)He^4$, 16: 21401
CAPPELLER, U., Analyzer with high time resolution, 16: 20775
CAPPS, Richard H., Determining $K\Sigma N$ parity, 16: 21326
CAPROTTI, M., Chemical protection in radioinduced lesions, 16: 20219
CARLSON, Anton B., Contamination and decontamination of reactors, 16: 21717 (DP-682)
CARLSON, B. C., Charged liquid drop with high angular momentum, 16: 21508
CARLSON, Robert Lewis, Amplifiers for ionization chambers, 16: 20680
CARNES, William H., Urethan induction of thymic lymphoma, 16: 20074
CAROVILLANO, R., Indistinguishability of nucleons and nuclear reactions, 16: 21623
CARPENTER, James F., Prog. rpt. on UO_3 powders, 16: 20961 (UNC-[illegible])
CARR, Charles W., Binding of Ca and Sr, 16: 20111
CARR, T. E. F., Assay of Ca-45 by scintillation counting, 16: 20334
CARR, T. E. F., Availability to man of Sr in milk, 16: 20899
CARRAHER, T. J., Prog. rpt. on radiacmeter research, 16: 20625 (AD-265927)
CARRUTHERS, P., Thermal conductivity of solids. III., 16: 21196
CASANOVA, J., Development of nuclear emulsions. I., 16: 21145
CASE, Laura K., Plasma torch chemistry, 16: 20391
CASEY, A. T., Solvent extraction from halide solutions. II., 16: 20451
CASPER, A. W., Fast neutron attenuation functions, 16: 21335 (XDC-60-76)
CASPERS, H. H., Infrared-absorption spectra of LiOH and LiOD, 16: 20409
CASSAGNOU, Y., Excitation functions of $V^{51}(p,n\gamma)Cr^{51}$, 16: 21626
CASTAGNOLI, C., Proton-nucleon collisions, 16: 21286
CASTELLI, Carlo A., Effects of radiation on formed elements and fractions of protein in thoracic duct lymph, 16: 20259
CATALA, J., Development of nuclear emulsions. I., 16: 21145
CATSCH, A., Decorporation of radiostrontium, 16: 20060
CELLINI, R. F., Separation of rare earths, 16: 20543
CERRAI, E., Preparation of Th thin layers, 16: 20963
CERRAI, E., Separation of rare earths. I., 16: 20546
CHABAI, A. J., Cratering experiments in desert alluvium, 16: 20049 (SC-4596(RR))
CHADAN, K., Left-hand cut discontinuity, 16: 21297
CHAMBIONNAT, Andre, Formation of alkaline earth uranates, 16: 20395
CHAMINADE, R., Inelastic scattering of 43-Mev α particles, 16: 21514
CHAN, Hong-Mo, Branch points of n-particle reaction amplitudes, 16: 21201
CHANG, C. T., Relaxation phenomena behind strong shock in H. I.,

16: 21666 (RISÖ-35)
CHANG, David B., Effect of geomagnetic fluctuations on trapped particles, 16: 21245
CHAPMAN, R. A., Thermoelectric direct-conversion nuclear reactors, 16: 21791 (AD-267442)
CHARLESBY, A., Radiation protection with sulfur compounds, 16: 20507
CHASE, F. L., Jr., Reaction $C^{14}(He^3,n_0)O^{16}$ and $C^{14}(He^3,n_1)O^{16}$, 16: 21595
CHAU, Nguyen Phong, Motion in asymmetric field theory, 16: 21283
CHAUDHRY, R., Angular distribution of fission fragments, 16: 20736
CHELEMEN, N., Influence of radiation on treatment of trypanosomiasis, 16: 20256
CHEN, H. Y., Reduced widths in (d,p) stripping experiments, 16: 21356 (NYO-2666)
CHEN, Kun-Mu, Interaction of EM fields with plasmas, 16: 21661 (AFCRL-746)
CHEN, Kwo-chyung, Investigation on manufacture of portable Geiger counter, 16: 20666
CHENG, Hwai-pin, Mutations induced by x rays in sweet potatoes, 16: 20178
CHENG, Li-Jen, Study of fall-out in Taiwan, 16: 20664
CHERENKOV, V. B., Velocity and concentration of particles in plasma flow, 16: 21671
CHERNETSOV, S. M., Effect of radiation on polyethylene insulation, 16: 20518
CHERNOCK, W. P., Prog. rpt. on UO_2 fuel systems, 16: 20951 (CEND-149)
CHERNYAK, N. Ya., Gamma radiolysis of hexane, 16: 20512
CHEVALLIER, P., Transitions in O-16, 16: 21411
CHEW, Geoffrey F., S-matrix theory of strong interactions, 16: 21329
CHI, B. E., Asymmetric core collective model for odd-A nuclei, 16: 21459
CHIAVASSA, E., Operation of electrostatic neutron source, 16: 21657
CHICK, Helen J., Detonation of mixed explosive substances, 16: 20375 (AEC-tr-5100)
CHICK, Helen J., Energy spectrum of resonance absorption of γ rays in Zn-67, 16: 21362 (AEC-tr-5115)
CHIEN, Chi-peng, Penetration effect of fast neutrons in moderators, 16: 21337
CHIN, Jia H., Absorption coefficient in transport equation, 16: 21328
CHIPMAN, John, Boron nitride in Fe–B alloys, 16: 21073
CHIRKOV, I. V., Thorium mineral resources, 16: 20852
CHITNIS, E. V., Image-intensifier system, 16: 20720
CHMUTOV, K. V., Sorption of radioelements by soils. I., 16: 20460
CHMUTOV, K. V., Sorption of radioelements by soils. II., 16: 20461
CHMUTOV, K. V., Sorption of radioelements by soils. III., 16: 20462
CHOU, Ling-han, Study of fall-out in Taiwan, 16: 20664
CHOWN, J. B., Geophysical experiments pertinent to nuclear blackout—final rpt., 16: 20814 (NP-11603)
CHRAPLYVY, Zeno V., Solutions of modified Dirac equation, 16: 21261 (AFOSR-TR-60-172)
CHRISTENSEN, W. J., Blast protection for minimum cost, 16: 20869 (NP-11653)
CHRISTMAS, P., Proton-proton polarization between 30 and 100 Mev, 16: 21486
CHRISTY, R. F., Electromagnetic transitions from the continuum, 16: 21451
CHUBAREV, S. I., Processing data from multi-channel analyzers, 16: 20771
CHUBB, T. A., X-ray emission from the sun, 16: 21232
CHURCHILL, Stuart W., Absorption coefficient in transport equation, 16: 21328
CHUVELEVA, E. A., Sorption of radioelements by soils. I., 16: 20460
CHUVELEVA, E. A., Sorption of radioelements by soils. II., 16: 20461
CHUVELEVA, E. A., Sorption of radioelements by soils. III., 16: 20462
CIGNA, A., Intake of I-131 from milk in Italy, 16: 20127
CINDRO, N., Interaction of 14-Mev neutrons with nuclei, 16: 21586
CIRILOV, Silva D., Elastic scattering of deuterons by C, 16: 21629
CLAMANN, Hans G., Energy conversion and balance, 16: 20237
CLARE, V. R., Prog. rpt. on biological effects of blast, 16: 20864 (DASA-1242)
CLARK, M. A., A2 assignment for 4.97-Mev level in Ne-20, 16: 21632
CLARK, Marie C., Trace elements in G-1 and W-1, 16: 20831
CLARK, W. E., Darex Process, 16: 20536 (ORNL-2712)
CLARKE, F. J. P., Microcrack growth in Mn oxide, 16: 20436
CLAYTON, C. G., Performance of scintillation counters, 16: 20714
CLEGG, A. B., Gamma rays from proton scattering from C, 16: 21468
CLEGG, A. B., Level schemes of Na-23, Al-27, and P-31, 16: 21407
CLEGG, A. B., Reactions (n,np), (p,pn), and (p,2p) on C-12, 16: 21466
CLEGG, A. B., Scattering of 150-Mev protons from Ca-40, 16: 21500
CLEMENS, Herbert, Biological effects of electron irradiation, 16: 20224
CLENDINNING, W. R., Thermoelectric direct-conversion nuclear reactors, 16: 21791 (AD-267442)
COAHRAN, David R., Effect of uv irradiation on nucleic acid, 16: 20150
COATES, D. W., Analysis of flash tube data, 16: 20679
COATES, D. W., Design of flash tube arrays, 16: 20680
COATES, Gruhen, Fuel elements for nuclear reactors, 16: 21765
COBLE, R. L., Ceramographic techniques. I., 16: 21052
COCHINAL, Roland, Coordinates of suspected elements in a network, 16: 20577
COCHRAN, A. A., Radiation effects on chlorination of rutile, carbon, and catalysts, 16: 20468 (BM-RI-5994)
COCKING, S. J., Thermal neutron analyzer, 16: 21333 (CRRP-1078)
CODD, J., Sodium reactivity effects in dilute fast reactor, 16: 21711 (AEEW-M-225)
COENRAADS, C. N., Electrostatic generators for spacecraft, 16: 21855
COHEN, A. V., Inelastic scattering from collective nuclei, 16: 21504
COHEN, B. L., Neutron levels in the Zr region, 16: 21495
COHEN, Bernard L., Experimental evidence for collective oscillations, 16: 21492
COHEN, E. G. D., Problems in statistical mechanics, 16: 20949
COHEN, L., Matrix elements for tritons, 16: 21284
COHEN, S. G., Nuclear moments of states of Dy-161, 16: 21526
COLBETH, E. A., Program for multiple lethargy level cell corrections for slab cells, 16: 21721 (MND-C-2500-2)
COLE, G. H. A., Hydromagnetic heat transfer, 16: 20607
COLE, Leonard J., Aging at the cellular level, 16: 20263
COLEMAN, K., Intensifier tube development, 16: 20721
COLEMAN, R. F., Survey of (F-19, F-18) neutron transfer reactions, 16: 21428
COLI, M., Memorizing circuit for long pulses, 16: 20804
COLLI, L., Cross section of $Si^{28}(n,\alpha)Mg^{25}$, 16: 21413
COLLINS, Doris N., Lymphocytic choriomeningitis in mice. II., 16: 20272
COLLINSON, E., Radiation chemistry of organic compounds, 16: 20511
COMPTON, D. M. J., Prog. rpt. on radiation effects on Si solar cells, 16: 21092 (GACD-3001)
COMSA, George, Metal-to-metal and ceramics-to-metal seals, 16: 20566 (IFA/TV/14)
CONGDON, Charles C., Antibody-forming cells in radiation chimeras, 16: 20273
CONGELLIERE, James, Gravity problems in space powerplants, 16: 21852
CONLAY, J. J., Radiation chemistry of organic compounds, 16: 20511
CONNOR, Donald, Sign of the Li-8 magnetic moment, 16: 21419
CONRAD, Edward E., Gamma-induced photoconductivity in capacitor, 16: 21088 (DOFL-TR-1037)
CONWAY, D. C., Attachment of low-energy electrons to O_2, 16: 20407
COOK, C. J., Geophysical experiments pertinent to nuclear blackout—final rpt., 16: 20814 (NP-11603)
COOKSON, J. A., Inelastic scattering from collective nuclei, 16: 21504
COOMBS, F. L., Nuclear accidents and legal remedies, 16: 20052
COOPER, John W., Collision cross sections for O, C, Cl, and F, 16: 21202
COOPER, Ralph S., Performance of optimized multistage rockets, 16: 21848 (LA-2677)
COOPER, W. A., Low-energy particles from CERN PS, 16: 21645 (CERN-62-19)
COPELAND, Edmond S., Radiation-induced regression of Murphy-Sturm lymphosarcoma, 16: 20131 (UR-575)
COPPER, Ann S., Precise lattice constants, 16: 20380
CORINALDESI, E., Scattering of a particle by bound identical particles, 16: 21312
CORIOU, H., Corrosion of Zy by H_2O or steam, 16: 20985
CORK, B., Polarization in π^--p scattering, 16: 21323
CORNECI, I., Influence of radiation on treatment of trypanosomiasis, 16: 20256
CORNISH, J. J., Determination of Th, Ra, and Pb in monazites, 16: 20325 (NP-tr-895)

CORTELLESSA, G., Program for calculation of telescope angles, 16: 20636 (ISS-61/17)
CORTINOVIS, R., Radiation effects on salivary glands, 16: 20216
COSSLETT, V. E., Electron beam cross sections, 16: 21155
COST, James R., Emissivities of Nb, 16: 21077
COSTIKAS, A., Photoequilibrium between KCl F and F' centers, 16: 21193
COSTRELL, L., Charge-storage techniques, 16: 20760
COTTS, R. M., Magnetic resonance of Li V bronze, 16: 21123 (AFOSR-1959)
COULSON, C. A., Self-interaction in Thomas-Fermi potential, 16: 21212
COURANT, H., Low-energy particles from CERN PS, 16: 21645 (CERN-62-19)
COX, A. Lucile, Toward colloid propulsion, 16: 21856
COX, Harry Albert, Moderator core structures, 16: 21769
COX, J. W., TORY II-A design, 16: 21822 (UCRL-6305)
COYNE, Andre, Improvements in reactors, 16: 21766
CRAFTS, Cecil Annand, Amplifiers for ionization chambers, 16: 20690
CRAMER, W. A., Muon capture rates for Ca-44 and Ca-40, 16: 21399
CRAMER, W. A., Muon capture by F-19, 16: 21400
CRANSHAW, T. E., Observations on extensive air showers. IX., 16: 21255
CRAWFORD, George W., Reaction of secondary cosmic rays, 16: 20240
CRAWFORD, J. H., Jr., Trapping centers in Ge. II., 16: 21187
CRAYTON, N., Binding energy data from hypernuclei, 16: 21490
CRESSWELL, Derek John, Improvements in nuclear reactors, 16: 21767
CRETELLA, Ruben F., Isotopic exchange of D, 16: 20923 (NP-11789)
CRETIUS, K., Roentgenofluorimetric determination of inorganic constituents. I., 16: 20097
CRETIUS, K., Roentgenofluorimetric determination of inorganic constituents. II., 16: 20098
CRETTEZ, J. P., Apparatus for discriminating shapes, 16: 20786
CREW, R. J., Water transport of particulate matter, 16: 20594 (USNRDL-TR-436)
CROOK, M. A., Gel formation in PVC on irradiation, 16: 20504
CROPPER, William H., Gamma-induced coloration in solids, 16: 21099
CROSSLEY, Frank A., Prog. rpt. on ductile Be composites, 16: 21019 (ARF-2212-5)
CROUSE, Helen V., X-ray-induced recessive lethal in *Sciara coprophilia*, 16: 20138
CROUTHAMEL, C. E., Determination of nuclear constants, 16: 20302 (ANL-6477(p.217-23))
CROUTHAMEL, C. E., Energy conversion, 16: 20301 (ANL-6477(p.204-16))
CROWTHER, R. L., Thorium in boiling water reactors, 16: 21736
CRUT, M., Inelastic scattering of 43-Mev α particles, 16: 21514
CSABA, B., Effect of x rays on guinea pig, 16: 20252
CSAVINSZKY, P., Ionized impurity scattering in semiconductors, 16: 21195
CSERHATI, I., Action of x radiation on uv thrombopoietic factor, 16: 20290
CSERHATI, I., Thrombocytosis-producing action of serum of x-irradiated mice, 16: 20277
CUEVAS, J., Stopping power H_2 for charge-invariant atomic projectiles, 16: 21628
CULLIGAN, G., Muon capture by F-19, 16: 21400
CULVAHOUSE, J. W., Nickel ions in double-nitrate crystals, 16: 20412
CULVER, W. H., Nuclear gyros, 16: 20654
CUMBY, R. P., Pulse characteristics of phototubes, 16: 21437
CUMMING, J., Relations in $\bar{K}$-nucleon absorption. II., 16: 21299
CUMMINS, J. D., Signal-to-noise ratio of transfer function analyzer, 16: 20627 (AEEW-R-132)
CUNDY, D. C., Electron pairs from π^- mesons, 16: 21315
CUNNINGHAM, J. R., Facility for whole-body irradiation, 16: 20078
CURTIS, O. L., Jr., Trapping centers in Ge. II., 16: 21187
CUTLER, Ivan B., Diffusion of Co and Mg oxides, 16: 20395
CUTOLO L., Francisco, Reconnaissance for U in Peru, 16: 20819 (RME-4521)
CUYPERS, Y., Circulation time of peripheral blood, 16: 20053
CZERNIEWSKI, M., Graphite reflector in VVRS "EWA" reactor, 16: 21842

D

DABBS, J. W. T., Behavior of semiconductor detectors, 16: 20743
DABROWSKI, J., Calculation of optical potential, 16: 21477
DABROWSKI, Janusz, Calculation of the optical potential, 16: 21364
DAHL-JENSEN, E., Fading in nuclear emulsions, 16: 20685
DAINTON, F. S., Radiation chemistry of organic compounds, 16: 20511
DAINTON, F. S., Radiolysis of aqueous systems, 16: 20514
DAKOWSKI (DAKOVSKI), M., Radioactivity of slags used in building materials, 16: 20871 (PAN-269/I-A)
DALGARNO, A., Physics of upper atmosphere, 16: 21121 (AFCRL-1062-I)
DALGARNO, A., Thermal conductivity of atomic hydrogen, 16: 21209
DALITZ, R. H., Hypernuclei and the hyperon-nucleon interaction, 16: 21465
DAMIANO, V. V., Prog. rpt. on high-purity Be, 16: 20958 (NP-11702)
DANCOT, H., Radiocurability of primary lesions, 16: 20092
DANIEL, R. R., Composition of primary cosmic radiation, 16: 21250
DANYSZ, M., Note on $_{\Lambda}$He-7 hyperfragments, 16: 21322
DAPPRICH, A. E., Strength of thick-walled pressure vessels, 16: 21735
DARCEY, W., Inelastic scattering from collective nuclei, 16: 21504
DASCOLA, G., Proton-nucleon collisions, 16: 21286
DA SILVEIRA, Adel, Unusual eigenvalues of the energy operator, 16: 20941
DAVIDSON, J. P., Asymmetric core collective model for odd-A nuclei, 16: 21459
DAVIS, Leverett, Jr., Effect of geomagnetic fluctuations on trapped particles, 16: 21245
DAWSON, J. F., Level spectrum of O-18, 16: 21365
DAY, D. L., Prog. rpt. on Ti sheet rolling program, 16: 21009 (AD-264815)
DAYTON, Russell W., Prog. rpt. on civilian applications, 16: 20041 (BMI-1574(Del.))
DAZEY, Mitchell H., Theta pinch experiments, 16: 21658 (AD-265829)
DE, K. S., Hydrogen–deuterium exchange, 16: 20433
DE AGOSTINO, E., Crystal spectrometer, 16: 20678
DEAM, A. P., Electron density measurements with Pound system, 16: 21110 (AD-266197)
DEAN, O. C., Preparation and fabrication of ThO_2 fuels, 16: 20960 (ORNL-3225)
DEANE, A. M., Uranium(IV) perchlorate, 16: 20420
DEARNALEY, G., Evidence for new first-excited state in Mg-26, 16: 21527
DEARNALEY, G., Semiconductor counters, 16: 20752
DE BAETS, M., Theoretical analysis of control of IEP 3, 16: 20630 (CERN-62-1)
DE BEER, J. F., Observations on extensive air showers. IX., 16: 21255
DECK, R. T., Continuum Coulomb wave function, 16: 21165
DECKERS, H., Spectral analysis of fast neutrons, 16: 21338
DE CONINCK, R., Characteristics of SiC diodes, 16: 20751
DEDDENS, J. C., CETR core assembly physics and zero power tests, 16: 21795 (BAW-163)
DE FOUQUET, J., Fatigue of Zy-2, 16: 21065
DEHNHARD, D., Three alpha particle break-up of C^{12*}, 16: 21637
DE HOFFMANN, F., Gas-cooled high temperature reactor for ship propulsion, 16: 21826
DEINERT, R. H., Automatic data-taking system, 16: 20778
DE JUREN, J. A., Calibration of thermal neutron density, 16: 21339
DE LA CRUZ, F., Separation of rare earths, 16: 20543
DE LEON, Gerardo, Tagged red cell studies. I., 16: 20055
DELGADO, F. Palomares, Acid leaching of U mineral, 16: 20526
DELLIS, A. N., Electron temperature of plasma in strong shock wave, 16: 21668 (AERE-Trans-893)
DE LOTTO, I., Transistorized time-of-flight analyzer, 16: 20763
DE LOTTO, I., Transistor precision pulse shaper, 16: 20796
DELVES, L. M., Structure of He-4, 16: 21274
DE MARTINI, F., Discrimination in scintillation counters, 16: 20784
DE MENDONCA, Fernando, Ionospheric electron content, 16: 21247
DEMLEITNER, Helga, Radiation resistance in cervical carcinoma, 16: 20174
DENDY, P. P., Use of tritiated thymidine, 16: 20104
DENHOLM, A. S., Electrostatic generators for spacecraft, 16: 21855
DENIZ, V. C., Fast fission factor in heterogeneous lattices, 16: 21710 (AEET/RE/1)
DENMAN, Eugene Dale, Radiation measurements by frequency variation, 16: 20644 (TID-15702)
DENNEY, J. M., Radiation damage in semiconductors, 16: 21093 (NP-11655)
DE OLIVEIRA, C. G., Dirac equation in general relativity, 16: 21701
DE PINHO, Alceu, Classes of quadrupole magnetic γ transitions, 16: 21178
DE PLAEN, Paul, Dose differences in interstitial therapy, 16: 20093

DE-SHALIT, A., Effective moments in nuclei, 16: 21433
DE SILVESTRI, A., Glomerular microcirculation, 16: 20214
DE SOETE, D., Gamma spectrometry and Compton effect, 16: 20673
D'ESPAGNAT, B., Unitary symmetry, 16: 21305
DETRAZ, C., Emission of deuterons and tritons and correlations in nuclei, 16: 21488
DE TREZVINSKY, B., Determination of γ radiation dosage, 16: 20880 (CEA-tr-R-1572)
DEUSER, W. G., Separation of Sr from Rb, 16: 20332
DEUTCH, B. I., Magnetic moments using resonance fluorescence, 16: 21448
DEUTSCH, M., Nuclear g values of states of Sm-152, Gd-154, and Gd-156, 16: 21505
DEV, Brahm, Determination of Th with rutin, 16: 20427
DEVANATHAN, C., Oscillations of three-component assembly, 16: 21688
DE VILLIERS, J. A. M., Scattering of cosmic ray muons, 16: 21248
DEVINS, D. W., Scattering of 31-Mev protons from Ni-60, 16: 21576
DEVONS, S., Recoil methods for lifetimes of nuclear states, 16: 21441
DEVONS, Samuel, Instrumentation for nuclear physics, 16: 21605
DEVORET, R., Action of α particles on *E. coli* K 12 (λ), 16: 20140
DE VRIES, L. J., Discrimination in organic scintillation crystals, 16: 20788
DE VAARD, H., Calibrating and testing pulse-height converters, 16: 21439
DEVELL, E. H., Determination of nuclear constants, 16: 20302 (ANL-6477(p.217-23))
DE WIESS, F. A., Arcjet-propelled spacecraft, 16: 21854
DE WITTE, Leendert, Method of well logging, 16: 20919
D'HULST, Emission of deuterons and tritons and correlations in nuclei, 16: 21488
DICKE, R. H., Lee-Yang vector field, 16: 21236
DICKERSON, Ronald F., Prog. rpt. on civilian applications, 16: 20041 (BMI-1574(Del.))
DICKINSON, Dale, Image intensifier-scintillator for weak beams, 16: 20642 (NP-11663)
DIEMINGER, Walter, Magnetic fields, 16: 20234
DIETRICH, K., Binding energies of light hyperfragments, 16: 21476
DIEZ, R., Development of nuclear emulsions. I., 16: 21145
DILLON, R. L., Zirconium oxide corrosion product, 16: 20979 (HW-71958-RD)
DIH, G. U., Mechanism of reaction $C^{13}(He^3,\alpha)^{24}$, 16: 21551
DI NUNNO, J. J., Calculation of distance factors for reactor sites, 16: 21726 (TID-14844)
DIOGUARDO, P. R., Effects of elevated temperatures on alloys, 16: 21025 (ASD-TR-61-499)
DI PRIMA, R. C., Hydromagnetic stability, 16: 20945
DIRAC, P. A. M., Extensible model of the electron, 16: 21327
DMITRIEVA, N. A., Properties of plutonium halides, 16: 20366 (AEC-tr-4457(p.10-19))
DOBSON, P. N., Lectures on scattering theory, 16: 21260 (AFOSR-2409)
DO DANG GIU, Excitation of 15.1 Mev level of C-12, 16: 21481
DOELL, Ruth G., Urethan induction of thymic lymphoma, 16: 20074
DOGADKIN, B. A., Radiation vulcanization, 16: 20481
DOLBILKIN, B. S., Inelastic nuclear scattering of photons, 16: 21641
DOLGIREV, E. I., Nuclear radiation detectors, 16: 20689
DOLGOV, E. G., Permeability of tissues after radiation, 16: 20157
DONALD, R. A., Electron pairs from π^- mesons, 16: 21315
DONATO, M., Radiation effects on Zn oxide catalyst, 16: 20509
DONN, William L., Atmospheric waves from nuclear explosions. II., 16: 20839
DONNELLY, Barbara, Labeling the P of nucleotides, 16: 20494
DONOHUE, H. F., Fuel rod bowing in SRE, 16: 21722 (NAA-SR-6878)
DONOVON, F. M., Jr., Apparatus for evaluating thermal stress resistance of materials, 16: 21030 (DC-60-3-110)
DONZE, Gerard, Diffusion and solubility of Fe in Be, 16: 21054
DORIA, Gino, Antibody-forming cells in radiation chimeras, 16: 20273
DORLET, C., ESR in irradiated DNA, 16: 20195
DORNBERGER-SCHIFF, K., Structure of Sr germanate, 16: 20441
D'ORVAL, Ch. Clouet, Delayed neutrons in "Proserpine", 16: 21739
DOUGAN, P. W., The L/K-capture ratio of Ar-37, 16: 21408
DOUMANI, Thomas F., Distillation process and apparatus, 16: 20921
DOUST, C., Localization of positron sources, 16: 20076
DOW, D. G., Plasma confinement by d-c fields, 16: 21678
DOWD, J., Image-intensifier system, 16: 20720
DOWDEN, R. L., Generation of exospheric noise, 16: 21231
DOWNING, R. G., Radiation damage in semiconductors, 16: 21093 (NP-11655)
DOWNS, L. E., Thermal protection by window glass, 16: 20860 (AFSWP-792)
DOWSON, D. C., Wood density measurements in criticality clearance of transport containers, 16: 20861 (AHSB(S)R-36)
DOYLE, E. D., Prog. rpt. on flow balancing device in BWR, 16: 21820 (TID-15436)
DOYLE, William T., Resonance studies of color centers, 16: 21194
DRAGHICESCU, M., Development of Geiger-Mueller counters, 16: 20741
DRAYCOTT, A., Corrosion of alloy steels, 16: 20986
DREHMANN, Ursula, Separation of In-111 from Cd targets, 16: 20551
DREVER, R. W. P., The L/K-capture ratio of Ar-37, 16: 21408
DREW, Thomas B., Advances in chemical engineering. II., 16: 20312
DRISKO, R. M., Distorted-waves calculation of direct reactions, 16: 21579
DROZDOV, N. G., Cadmium sulfide γ-detectors, 16: 20663
DRUMMOND, I. T., Analytic properties of cross sections, 16: 21290
DUCROS, G., Cherenkov effect of β particles, 16: 20712
DUCROS, R., Cherenkov effect of β particles, 16: 20712
DUDLEY, H. C., Therapy of multiple myeloma with Y-90, 16: 20070
DUGAN, F. A., Cooling facility for reactor irradiations, 16: 21737
DUGNANI, R., Preparation of Th thin layers, 16: 20963
DULBERGER, Leon H., Well-logging technique to probe moon, 16: 20659
DU MOND, J. W. M., Diffraction monochromator for study of nuclear resonance excitation, 16: 21443
DUNAITSEV, A. F., Conserved vector current hypothesis, 16: 21321
DUNMUR, I., Properties of solid-state detectors, 16: 20750
DUPETIT, G. A., Ionization chamber for α-particle analysis, 16: 20643 (NP-11691)
DUPLAN, J. F., Fetal production of cells, 16: 20160
DUPONT, John A., Electrophilic D exchange reaction, 16: 20397
DURGAPRASAD, N., Composition of primary cosmic radiation, 16: 21250
DURSTON, C., Sodium reactivity effects in dilute fast reactor, 16: 21711 (AEEW-M-225)
DUTILLOY, Daniel, Diffusion and solubility of Fe in Be, 16: 21054
DYORETSKII, A. S., Particle entry into an emulsion chamber, 16: 20737
DYBCZYNSKI, Rajmund, Separation of rare earths. III., 16: 20549
DYCE, R. B., Geophysical experiments pertinent to nuclear blackout—final rpt., 16: 20814 (NP-11603)
DYMKOV, Yu. M., Coffinite and nature of nasturan pseudocrystals, 16: 20834
DYSON, N. A., Electric dipole moment of photons, 16: 21314
DZHAKOV, E., Pulse scaler using multi-stable system, 16: 20794
DZHURAKULOV, Kh., Secondary emission from Mo, 16: 21156

E

EARL, James A., Solar cosmic rays over Minneapolis, 16: 21240
EARLE, E. D., Giant dipole resonance in O-16, 16: 21510
EARLE, E. D., Giant dipole resonance in Ca-40, 16: 21511
ECCLESHALL, D., Heavy ion excitation of Pd-108 and Pd-110, 16: 21516
ECCLESHALL, D., Oxygen ion excitation in Ru-102, Ru-104, Pd-106, Cd-112, and Cd-114, 16: 21517
ECKARD, S. E., Gas dynamic system for heating air, 16: 20559 (DC-59-5-41)
ECKARD, S. E., System for heating clean air to 3100°F, 16: 20560 (DC-59-6-253)
ECKARDT, A., 1-Mv cascade generator, 16: 21655
ECKHAUSE, M., Fermi-Teller Z-law, 16: 21174
EDLUND, M. C., CETR core assembly physics and zero power tests, 16: 21795 (BAW-163)
EDMONDS, Frank N., Jr., Energies from cosmic sources, 16: 20232
EDWARDS, S. F., Electronic structure of liquid metals, 16: 20439
EGAN, G., Prog. rpt. on radiacmeter research, 16: 20625 (AD-265927)
EGELSTAFF, P. A., Scattering law experiment, 16: 21331 (AERE-R-4019)
EGELSTAFF, P. A., Scattering of thermal neutrons by moderators, 16: 21332 (AERE-R-4041)
EGELSTAFF, P. A., Thermal neutron analyzer, 16: 21333 (CRRP-1078)
EHLERS, F. Edward, Interaction of plasma jet with magnetic field, 16: 20619

EHLERS, J. Edward, Symposium on heat transfer, 16: 20613
EIDMAN, V. Ya., Radiation of electromagnetic waves, 16: 21316
EINBINDER, I., Growth of graphite from melts, 16: 21066
EISLER, M., Excretion of radioactivity, 16: 20084
EK, F., Theoretical hydromagnetic shocks, 16: 21662 (AFSWC-TDR-62-42)
EKERT, B., Radiochemical investigation of nucleic acids, 16: 20515
ELCO, R. A., MHD journal bearing, 16: 20570
ELDRED, V. W., Post-irradiation examination facilities at Windscale Works, 16: 21089 (DPR/INF/265)
ELIEZER, I., Stability of mixed complexes, 16: 20355 (IA-731)
ELLIOTT, D. E., Behavior of graphite and Be, 16: 20809
ELLIOTT, David G., Two-fluid MHD cycle for power conversion, 16: 21151
ELLIOTT, L. A., Shock fronts in two-dimensional flow, 16: 21210
ELOVICH, S. Yu., Chromatography of univalent ions. I., 16: 20457
ELOVICH, S. Yu., Chromatography of univalent ions. II., 16: 20458
ELTON, L. R. B., Wave distortion in direct interactions, 16: 21591
EMAN, B., Interaction of 14-Mev neutrons with nuclei, 16: 21586
EMERY, G. T., Properties of collective states in Os-186, 16. 21461
EMMETT, M. B., Program for computing γ transmission through slabs, 16: 20931 (ORNL-TM-167(Rev.))
ENCE, Elmers, Study of Ti–Cu–Zr system, 16: 21074
ENGBERG, Ralph E., Control rod actuator mechanism, 16: 21789
ENGE, H. A., Reduced widths in (d,p) stripping experiments, 16: 21356 (NYO-2666)
ENGELMANN, R. J., Hanford raindrop sampler and selected spectra, 16: 20565 (HW-73119)
ENGELSBERG, Stanley, Collective excitations in a crystal, 16: 21182
ENGELSBERG, Stanley, Theory of superconductivity, 16: 21181
EPPLE, Robert P., Space environment and its interactions with propellants, 16: 21845 (AD-266034)
EPSTEIN, L. M., Mossbauer spectra of some Fe complexes, 16: 20413
EREDE, Paolo, Oxidative phosphorylation in rats irradiated with Co-60 16: 20286
EREDE, Paolo, Serum protein levels in rats irradiated with Co-60, 16: 20287
ERMAKOV, V. S., Organic loop in IRT-2000 Reactor, 16: 21841
ERNST, W. S., Jr., Preparation and fabrication of ThO_2 fuels, 16: 20960 (ORNL-3225)
ERRAMUSPE, H. J., Interaction of deuterons with N, 16: 21355 (NP-11697)
ERSHLER, B. V., Radiolysis of aqueous solutions, 16: 20520
ERSHLER, B. V., Recombination of radicals under radiolysis, 16: 20521
ERWIN, A. R., Production of Y_1^0 and K^* in π-p collisions, 16: 21289
ESPAGNO, L., Comparison of H–Hf and H–Zr systems, 16: 21064
ESTEN, M. J., Fast neutrons from p-d collisions, 16: 21475
EVANS, J. A., Pairing forces near closed shells, 16: 21509
EVANS, J. E., Angular distributions of $Be^9(d,n)B^{10}$ neutrons, 16: 21588
EVANS, J. E., 2.2-Mev level in Al-27, 16: 21519
EVANS, Martha W., Interaction of shock or rarefaction with a bubble, 16: 20608
EVANS, P. E., Structure of U_2N_3, 16: 20396
EVANS, Robley D., Radiation dose in space vehicles, 16: 21844 (AD-263476)
EVANS, Titus C., Electromagnetic radiation, 16: 20244
EVANS, W. H., Electron pairs from π^- mesons, 16: 21315
EVAN, G. T., Energy levels of Gd-156, 16: 21506
EWING, Maurice, Atmospheric waves from nuclear explosions. II., 16: 20839

F

FABRI, E., Relativistic three-body systems, 16: 21704
FACCHINI, U., Cross section of $Si^{28}(n,\alpha)Mg^{25}$, 16: 21413
FACER, J. F., Direct hydrofluorination of Pu(III) oxalate, 16: 20354 (HW-19771)
FACKLER, John P., Jr., Stretching frequency in metal complexes, 16: 20421
FACUGAUCHI, Maria Elena, Radioactive measurements in the living fish, 16: 20059
FAES, M. H., Skin decontamination in presence of Tl-204, 16: 20895
FAINI, G., Signal-to-noise in nuclear magnetometer, 16: 20682
FARAGGI, H., Inelastic scattering of 43-Mev α particles, 16: 21514
FARBER, Miriam B., Transfer of rabbit lymph node cells, 16: 20275
FARGO, J. J., Flat plate ceramic fuel elements, 16: 21819 (TID-15373)
FARLEY, T. A., Mirror point densities in outer radiation zone, 16: 21244
FARMER, F. R., Evaluation of power reactor sites, 16: 20865 (DPR/INF/266)
FARWELL, G. W., Systematics of octupole states, 16: 21523
FAUSTOV, R. N., Scattering of Λ and K_1^0 on H_2, 16: 21264 (JINR-D-820)
FAXON, Robert, Prog. rpt. on specific volumes of liquid metals, 16: 21041 (TID-15663)
FEDER, H. M., Calorimetry, 16: 20299 (ANL-6477(p.155-67))
FEDER, Harold M., Thermodynamics of U–Cd system, 16: 21070
FEDOROV, G. G., Oxygenated complexes on the surface of graphite, 16: 20387
FEINBERG, R., Infrared heat transfer gage, 16: 20589 (AFCRL-942)
FEINGOLD, Milton, Maternal-fetal barrier in the mouse. I., 16: 20066
FEITH, A. D., Alternate fastener survey, 16: 20563 (DC-60-12-129)
FELD, B. T., Elementary particle physics lecture courses, 16: 21263 (CERN-62-14)
FELDMAN, Cyrus, Luminescence of salts of rare earths, 16: 20378 (AEC-tr-5112)
FELDMAN, G., Production of new heavy bosons, 16: 21291
FELDMAN, Myra S., Stress-corrosion cracking of stainless steel, 16: 20971 (DP-683)
FELTZIN, J., Prog. rpt. on resins and elastomers, 16: 20350 (AGC-0423-01-3)
FERGUSON, A. T. G., Angular distributions of $Be^9(d,n)B^{10}$ neutrons, 16: 21588
FERGUSON, A. T. G., Evidence for new first-excited state in Mg-26, 16: 21527
FERGUSON, A. T. G., Semiconductor counters, 16: 20752
FERGUSON, D. E., Preparation and fabrication of ThO_2 fuels, 16: 20960 (ORNL-3225)
FERRAR, Michael Hugh, Support means for pipes or ducts, 16: 21781
FERRELL, R. A., Giant dipole resonance transitions in nuclei, 16: 21435
FERRETTI, B., Reaction $Be^9(n,\alpha)He^6$, 16: 21401
FERRIS, L. M., Acid decomposition of Fe carbide, 16: 20377 (AEC-tr-5111)
FERRONI, S., Operation of electrostatic neutron source, 16: 21657
FIELD, M., Prog. rpt. on machining refractory materials, 16: 20990 (ASD-TR-7-532a(VI))
FILIPPAS, T. A., Fermi-Teller Z-law, 16: 21174
FILIPPOVA, T. I., Electron temperature of plasma in strong shock wave, 16: 21668 (AERE-Trans-893)
FILTHUTH, H., Low-energy particles from CERN PS, 16: 21645 (CERN-62-19)
FINK, F. W., Corrosion investigation of alloys, 16: 20974 (BMI-X-198)
FINKE, W., Patent rights and development of nuclear energy, 16: 20950
FINKEL, E. E., Effect of radiation on polyethylene insulation, 16: 20518
FINKELSTEIN, David, Foundations of quaternion quantum mechanics, 16: 21161
FINNEGAN, Camille, Radiation-induced hyperpyrexia in rabbits, 16: 20270
FINNEY, P. J., Interactions of π^- mesons with complex nuclei. III., 16: 21406
FINNIE, Lies N., Stability of solid phases, 16: 20394
FIREMAN, E. L., Ehole meteorite, 16: 20842
FISCHER, C., Fluorinating behavior of UO_2 powders, 16: 20432
FISCHER, C. C., Prog. rpt. on biological effects of blast, 16: 20864 (DASA-1242)
FISCHER, Heinz, High temperature production, 16: 20588
FISCHER, J., Fuel cycle applications of volatility and fluidization techniques, 16: 20298 (ANL-6477(p.106-54))
FISCHER, L., Density of H_2SO_4–UO_2SO_4–H_2O system, 16: 20435
FISHER, D. A., Radioiodine in children, 16: 20891
FISHER, Edwin L., Studies of nuclear debris in precipitation, 16: 20816 (NYO-9531)
FISHER, G., Neutral particles in 30° beam from AGS, 16: 21650 (NP-11624)
FISK, H. E., Sign of Σ hyperon nuclear potential, 16: 21483
FLAMANT, Y., Time-of-flight spectrometry of neutrons scattered by C, 16: 21378
FLANDERS, R. B., Thermoelectric direct-conversion nuclear reactors, 16: 21791 (AD-267442)
FLEISCHER, Michael, Data on rock samples G-1 and W-1, 16: 20833

FLEMMING, Kurt, Radiation protective effect of ethyl palmitate, 16: 20284
FLETCHER, Leslie Maurice, Shutting down of nuclear reactors, 16: 21756
FLETCHER, W. H., Spectra of trifluoride-dimethyl ether complex, 16: 20445
FLEURY, Georges, Nuclear energy and space problems, 16: 21857
FLICKINGER, R. F., CETR core assembly physics and zero power tests, 16: 21795 (BAW-163)
FLINN, R. A., Effect of γ' particle size on Ni alloys, 16: 21008 (AD-263483)
FLOWERS, B. H., Pairing correlations in nuclei, 16: 21491
FLOYD, J. J., Cooling facility for reactor irradiations, 16: 21737
FOLEY, K. J., Level schemes of Na-23, Al-27, and P-31, 16: 21407
FOLEY, K. J., Reactions (n,np), (p,pn), and (p,2p) on C-12, 16: 21466
FOLK, R., Binding energies of light hyperfragments, 16: 21476
FOMIN, V. V., Extraction of Pu(IV) with TBP, 16: 20369 (AEC-tr-4457 (p.161-6))
FOMIN, V. V., Properties of plutonium halides, 16: 20366 (AEC-tr-4457 (p.10-19))
FOMIN, V. V., Stability constants of $Ce(NO_3)_y$ ions, 16: 20370 (AEC-tr-4457(p.167-82))
FONER, S. N., Dissociation of H peroxide by electron impact, 16: 20410
FONER, S. N., Mass spectrometry of the HO_2 free radical, 16: 20339
FONTAN, J., Radon and thoron in the atmosphere, 16: 20848
FORD, K. W., Mechanism of resonances, 16: 21303
FORSHUFVUD, Sten, Arsenic in Napoleon's hair, 16: 20344
FORSTER, H. H., Scattering of 31-Mev protons from Ni-60, 16: 21576
FORTE, M., Discriminating scintillation shapes, 16: 20785
FORTY, A. J., Radiation effects on KCl crystals, 16: 21105
FOSTER, M., Energy conversion, 16: 20301 (ANL-6477(p.204-16))
FOSTER, R., Rat liver after x radiation *in vivo*, 16: 20199
FOSTER, R. F., Radiological conditions in vicinity of Hanford, 16: 20868 (HW-71999)
FOUCHER, Roger, Classes of quadrupole magnetic γ transitions, 16: 21376
FOUNTAIN, E. S., Balmer spectra in presence of h-f discharge, 16: 21143 (NP-tr-886)
FOUNTAIN, R. W., Boron nitride in Fe–B alloys, 16: 21073
FOURE, C., Influence on burnout flux of vortices induced in boiling water, 16: 20598 (EURAEC-146)
FOURE, C., Prog. rpt. on two-phase flows, air–water, 16: 20597 (EURAEC-144)
FOWLER, William Alfred, Rutherford and nuclear cosmochronology, 16: 21606
FOX, B. J., Corrosion of alloy steels, 16: 20986
FRANCIS, Kenneth E., NMR measuring device, 16: 20703
FRANCIS, L. S., Radiation protection (reading list), 16: 20859 (AERE-READING-LIST-8)
FRANCIS, N. C., Photodisintegration below the giant resonance. I and II., 16: 21585
FRANK, J. P., Prog. rpt. on radiacmeter research, 16: 20625 (AD-265927)
FRANK, P. W., Failed element detection and location system, 16: 21823 (WAPD-PWR-TE-70)
FRANK, William M., Expansions in cutoff meson theories, 16: 21278
FRANKOWSKI, Wladyslaw, Siting high flux reactor, 16: 21744
FRASER, J. P., Reactor fuel matrix cooled by free convection, 16: 21720 (KAPL-M-PF-6)
FREDERICK, D. H., Program for multiple lethargy level cell corrections for slab cells, 16: 21721 (MND-C-2500-2)
FREEMAN, A. J., Magnetic and spectroscopic properties of rare-earth ions, 16: 21128 (MRL-118)
FREEMAN, J. D., Incrementally magnetized cores, 16: 20660
FREEMAN, J. M., Reaction (p,n) Q values in β decay, 16: 21615
FREINDL, L., Scattering of 13-Mev deuterons on light nuclei, 16: 21566
FREHLIN, J. H., Electric dipole moment of photons, 16: 21314
FRENCH, J. B., Direct interaction processes, 16: 21546
FREREJACQUE, D., Prog. rpt. of Linear Accelerator Lab., 16: 21646 (LAL-1010)
FREREJACQUE, D., Prog. rpt. of Linear Accelerator Lab., 16: 21647 (LAL-1021)
FRETTER, W. B., Ionization by relativistic particles, 16: 21288
FRIDMAN, A. S., Effect of radiation on polyethylene insulation, 16: 20518
FRIEDLAENDER, E. M., Energy spectrum of γ rays. I., 16: 21389
FRIEDMAN, H., X-ray emission from the sun, 16: 21232
FRIEDMAN, Robert M., Antibody in recovery from infection with vaccinia virus, 16: 20270
FRIESE, Thomas, Dead-time corrector in radiation detector, 16: 20675
FRIK, W., Iron filters in x-ray diagnosis, 16: 20086
FRISCH, D. H., Cylindrical spark counter, 16: 20731
FROST, A. A., Atomic orbitals in molecular orbitals. I., 16: 20411
FROWNFELTER, C. R., Prog. rpt. on welding refractory metals, 16: 20987 (AD-266249)
FRYER, Misot P., Repair of x-ray burns, 16: 20136
FUJII, A., Muon and pion capture in He-3, 16: 21384
FUJINO, Toyoni, Localization of gastrointestinal hemorrhage, 16: 20058
FUJITA, Akira, Observation of fall-out, 16: 20121
FUJITA, Akira, Radioactive air-borne dusts, 16: 20122
FUJITA, Jun-ichi, Beta decay of RaE, 16: 21612
FUJITA, S., Theory of transport coefficients. I., 16: 21166
FUJITA, S., Theory of transport coefficients. II., 16: 21167
FUKUDA, Kyuo, Calorimeter for intense electron beams. I., 16: 20651
FULBRIGHT, H. W., Reaction $C^{13}(d,n)N^{14}$, 16: 21589
FULMER, C. B., Pickup reaction studies of Fe-54 and Co-59, 16: 21563
FULMER, C. B., Pickup reaction evidence for deformation of Fe-56, Fe-57, and Fe-58, 16: 21564
FULTON, T., Production of new heavy bosons, 16: 21291
FUNDERBURG, John, Physics program for SSCR, 16: 20863 (BAW-1215(and Suppl.1))
FUNG, F. C. W., Sink flow in strong magnetic field, 16: 20609
FUNSHTEIN, L. V., Atlas of acute radiation sickness, 16: 20295
FUNT, B. L., Quenching in liquid scintillators, 16: 21158
FURET, J., Control of high flux reactors, 16: 21738
FURUTA, J., Distribution and leakage of γ-rays, 16: 20881
FURUTA, Junichiro, Radiation damage of shielding glass, 16: 21097
FURUTA, Junichiro, Radioactivation of In-115, 16: 21366
FUTTERKNECHT, R., Emission of H-3 from illuminants, 16: 21367
FUTTERKNECHT, Rudolf, Ionization measurement instrument, 16: 20702

G

GABRIEL, A. H., Spectroscopic studies, 16: 21684
GABRIEL, Alan Henry, Spectrograph, 16: 20578
GAILLEDREAU, C., Cesium uptake by Saclay soil, 16: 20826
GAJEWSKI, W., Double emission of Li-8 fragments, 16: 21415
GALASIEWICZ, Zygmunt, Moments of inertia of nuclei, 16: 21387
GALE, N. H., Direct interaction in α-induced reactions, 16: 21601
GALE, N. H., Distorted wave effects in stripping, 16: 21587
GALINDO, A., Pure states of n-identical particles, 16: 21280
GALLAGHER, C. J., Jr., Decay of 2.1-hour Ta-178, 16: 21422
GALLAGHER, C. J., Jr., States in deformed even-even nuclei, 16: 21423
GALUS, Z., Spectrum of N,N'-tetramethylbenzidine, 16: 20419
GANIS, Frank M., Support for paper chromatography, 16: 20342
GANSSEN, Alexander, Coupled electron and nuclear spin systems, 16: 21357 (RADC-TR-61-132)
GARCIA, A. L., Control of high flux reactors, 16: 21738
GARCIA-MUNOZ, M., Stopping power H_2 for charge-invariant atomic projectiles, 16: 21628
GARDNER, J. W., Nimrod external proton beam, 16: 21649 (NIRL/R/12)
GARETTA, D., Inelastic scattering of 43-Mev α particles, 16: 21514
GARG, J. B., Direct interaction in α-induced reactions, 16: 21601
GARG, J. B., Distorted wave effects in stripping, 16: 21587
GARLAND, R. J., Transportation of nuclear products, 16: 20896
GARRATT, P. G., Radiation protection with sulfur compounds, 16: 20507
GARRIGUE, Hubert, Radioactivity of air and precipitations, 16: 20887
GARRON, J. P., Momentum distribution of protons in C-12 nucleus, 16: 21489
GARVEI, H. H., Treatment of radiation injuries, 16: 20278
GASANOV, G. I., Toxic effect of oxidation products of oleic acid on yeast cells, 16: 20063
GAST, R. G., Self-diffusion of cations in clay-water systems, 16: 20425
GATTI, E., Discrimination in scintillation counters, 16: 20784
GAUNT, Ian Alexander Butler, Improvements relating to nuclear reactors, 16: 21762
GAUTHRON, Maurice, Determining thermal stresses, 16: 20811
GAUTIER, André, Determining thermal stresses, 16: 20811
GAUTRON, René, Financial aspects of nuclear insurance, 16: 21733

GAVALA, Spiro, Effects of radiation on rat testes, 16: 20225
GAVALAS, G. R., Two-phase flow through an aperture, 16: 20615
GAYOSO, R. A., Ionization chamber for α-particle analysis, 16: 20643 (NP-11691)
GAZERT, V., Fission products from Northern Alps, 16: 20883
GAZZARRINI, F., Preparation of Th thin layers, 16: 20963
GEGNER, P. J., Performance of Ti in chemical plants, 16: 20983
GEHL, Mary A., Rare-earth distribution in sediments, 16: 20841
GEIGER, J. S., Energy levels of Gd-156, 16: 21506
GEISLER, M., Evaluation of γ scintillation spectrograms. II., 16: 20655
GEITHOFF, D., Recovery of P-32 and I-131 from irradiated material, 16: 20500
GELBARD, E. M., Program for calculation of capture probabilities, 16: 20933 (WAPD-TM-273)
GELLER, M., Atomic orbitals in molecular orbitals. I., 16: 20411
GEMESY, T., Extensive air showers in air, 16: 21251
GENDELL, Julius, Magnetic resonance of Li V bronze, 16: 21123 (AFOSR-1959)
GENGOZIAN, Nazareth, Antibody-forming cells in radiation chimeras, 16: 20273
GENIN, J., Emission of deuterons and tritons and correlations in nuclei, 16: 21488
GEORGE, G., Properties of solid-state detectors, 16: 20750
GERASIMOV, Ye. I., Thermodynamics of W oxides, 16: 21055
GERBER, H.-J., Neutral particles in 30° beam from AGS, 16: 21650 (NP-11624)
GERHART, J. B., Proton angular distributions for (α,p) reactions, 16: 21417
GERHOLM, T. R., Effects of nuclear penetration on electron-γ correlations, 16: 21449
GETOFF, N., Synthesis of organic products, 16: 20492
GETOFF, Nikola, Reduction of carbonic acid with uv, 16: 20519
GHOSE, T., Effect of irradiation on tumor metastasis, 16: 20268
GHYS, R., Radiation effects on sex hormones of rat. I., 16: 20183
GHYS, Roger, Radio-modifying action of sexual hormones, 16: 20185
GIAMATI, C. C., Large Cherenkov detector, 16: 20711
GIANNELLI, G., Neutron time-of-flight analyzer, 16: 20762
GIBBONS, P. E., Solid-state ionization chamber, 16: 20749
GIBBS, H. L., Radioactive tracers in Be metallurgy, 16: 20950 (BM-RI-5980)
GIBSON, J. A. B., Detection of H-3 with film dosimeter, 16: 20687
GIESECKE, Dieter, Radiation effects on cellulose decomposition, 16: 20206
GIGAS, G. G., Scattering of 31-Mev protons from Ni-60, 16: 21576
GILBERT, Walter, Gauge invariance and mass, 16: 21324
GILL, P. S., Forbush decreases at different latitudes, 16: 21253
GILLET, Vincent, Collective states of O-16 and C-12, 16: 21520
GILLHAM, Nicholas W., Mutant clones induced by uv in green algae, 16: 20203
GINGERICH, K. A., Cerium oxides. V., 16: 20363 (NP-tr-893)
GINN, M. E., Prog. rpt. on shielding materials, 16: 21690 (AD-267561L)
GINZBURG, V. L., Radiation of electromagnetic waves, 16: 21316
GIROUD, A., Congenital malformations, 16: 20210
GLAGOLEV, N. A., Uranium-bearing christobalite and tridymite in limestone, 16: 20824
GLASER, Peter E., Materials for vacuum insulation, 16: 20590 (ASD-TDR-62-88)
GLASGOW, J. W., Fabrication of thermocouples, 16: 20633 (DC-59-10-202)
GLASSTONE, Samuel, Effects of nuclear weapons, 16: 20908
GLENDENNING, N. K., Giant E1 resonance for deformed nuclei, 16: 21524
GLENDENNING, Norman K., Reactions (p,α) in mirror nuclei, 16: 21582
GLICK, A., Many-body perturbation in soluble model, 16: 21512
GLOVER, R. N., Isomeric cross section ratios, 16: 21385
GLOVER, R. N., Radioactivity among isobaric pairs, 16: 21405
GOBBI, A., Identification of B on Si, 16: 20346
GOCHALIEV, G. Z., Determination of γ radiation dosage, 16: 20880 (CEA-tr-R-1572)
GOEBEL, R., Electron beam welding, 16: 21000
GOETZ, G., 1-Mv cascade generator, 16: 21655
GOKSOEYR, Jostein, Automatic recording of respiratory $C^{14}O_2$, 16: 20326
GOLAND, A. N., Cooling facility for reactor irradiations, 16: 21737
GOLD, Albert, Ultraviolet absorption in rare gases, 16: 20417
GOLDFARB, L. J. B., Polarization effects in nuclear reactions, 16: 21580
GOLDFARB, L. J. B., Polarization correlation in direct reactions, 16: 21590
GOLDIN, Herzl, Effect of uv irradiation on bacteria, 16: 20149
GOLDIZEN, V. C., Prog. rpt. on biological effects of blast, 16: 20864 (DASA-1242)
GOLDMAN, D. T., Photodisintegration below the giant resonance. I and II., 16: 21585
GOLDMAN, David Tobias, Energy dissipation by bremsstrahlung spectrum, 16: 21135 (TID-15706)
GOLDMANN, Jack B., Bibliography on Be, 16: 20956 (NP-10640(Suppl.II))
GOLDRING, G., Particle beam lifetime measurements, 16: 21435
GOLDSCHMIDT, H. J., Tungsten–carbon equilibrium system, 16: 21022 (ASD-TDR-62-25(Pt.I))
GOLDSTEIN, J. H., Spectra of $H_2C-C^{13}H_2$ and H_2C-CHD, 16: 20429
GOLOVASTIKOV, N. I., Crystal structure of beryllonite, 16: 20442
GOLUTVINA, M. M., Obtaining carrier-free As-77 from irradiated Ge, 16: 20474 (CEA-tr-R-1476)
GOMBAS, P., Nuclear molecules of two C-12 nuclei, 16: 21220
GOMBOSI, E., Energy spectrum of γ rays. I., 16: 21389
GONZALEZ, A. Bellido, Acid leaching of U mineral, 16: 20526
GONZALEZ, F. Alvarez, Determination of impurities in rare earths, 16: 20327
GOOD, R. H., Jr., Integrals of motion for photons, 16: 21310
GOOD, Robert C., Jr., Prog. rpt. on structural response to electromagnetic radiation, 16: 21087 (AFOSR-2483)
GOODMAN, C. D., Nuclear distortion in the Fe region, 16: 21565
GOODMAN, C. D., Pickup reaction studies of Fe-54 and Co-59, 16: 21501
GOODMAN, C. D., Pickup reaction evidence for deformation of Fe-56, Fe-57, and Fe-58, 16: 21564
GOODMAN, Joan Wright, Antibody-forming cells in radiation chimeras, 16: 20273
GOODMAN, L. S., Angular momentum quantum number of Ho-165, 16: 21571
GOODSPEED, F. D., Temperature control of irradiations, 16: 20572
GOPINATH, D. V., Radioactive equilibrium, 16: 21345 (AEET/HP/4)
GORDON, Alvin S., Excited ethane and ethyl radicals, 16: 20408
GORDON, B. E., Labeling hydrocarbons, 16: 20490
GORELOV, N. I., Cadmium sulfide γ-detectors, 16: 20663
GORLOV, G. V., Neutron scintillation counter, 16: 20787
GORODETSKII, A. A., Aspects of radiobiology, 16: 20080
GORODETZKY, S., Nuclear lifetimes with time-to-height converter, 16: 21440
GORODETZKY, S., Transitions in O-16, 16: 21411
GORODETZKY, Serge, Plane polarization of AcC″ γ rays, 16: 21369
GORZHEVSKAYA, S. A., Thermal studies of U and U-bearing minerals, 16: 20853
GOUDSWAARD, B., Properties of Nd Mg nitrate, 16: 20438
GOULDING, F. S., Energy resolution in detectors, 16: 20756
GOUPIL, Jean, Burst jacket detection in nuclear reactors, 16: 21783
GOUPIL, Jean, Fission products in gases, 16: 20692(P)
GOURDIN, M., Relative ΣΛ parity, 16: 21300
GOUTIER, R., Effects of total irradiation of the rat, 16: 20255
GOUTIER-PIROTTE, M., Effects of total irradiation of the rat, 16: 20255
GOVE, H. E., A2 assignment for 4.97-Mev level in Ne-20, 16: 21632
GOVE, H. E., Evidence for direct interactions, 16: 21547
GRABCZAK, Jerzy, Natural radioactivity of Cu ores, 16: 20847
GRAESSLEY, William W., Fission product applications using β sources, 16: 20471 (NYO-9485)
GRAHAM, R. L., Energy levels of Gd-156, 16: 21506
GRAHAM, Robert J., Separation of immiscible liquids by gravity settling, 16: 20540 (UCRL-10048)
GRALL, L., Corrosion of Zy by H_2O or steam, 16: 20985
GRAHNEMANN, W. W., Hypersonic plasma generator, 16: 21139 (UNM-TP-EE-73)
GRANNIS, Paul, Radiation damage on lunar surface, 16: 21132 (NP-11662)
GRANT, Nicholas J., Grain boundary sliding in Al and its alloys, 16: 21001 (ASD-TR-61-383)
GRASSINI, G., Separation of inorganic ions in fused salts, 16: 20550
GRASSMANN, P., Nucleate pool boiling, 16: 20601
GRAUL, E. H., Emission of H-3 from illuminants, 16: 21367
GRAZIANO, Eugene E., Bibliography on all-metal sandwiches, 16: 20957 (NP-11677)

GREEN, A. M., Velocity dependent forces, 16: 21703
GREEN, A. M., Velocity-dependent nuclear forces, 16: 21535
GREEN, D. W., Attenuation of γ radiation in 2-legged rectangular duct, 16: 21692 (NP-11657)
GREEN, John W., Thermodynamic properties of i ons, 16: 20351 (ARL-191)
GREEN, L. L., Energy levels of Na-23, 16: 21498
GREEN, L. L., $Li^{7}(\alpha,\gamma)B^{11}$ reaction, 16: 21427
GREENBERG, Joseph, Therapy of multiple myeloma with Y-90, 16: 20070
GREENBERG, O. W., Lectures on scattering theory, 16: 21260 (AFOSR-2409)
GREENE, M. W., Production of Te-132, I-132, Mo-99, and Tc-99m, 16: 20544
GREENFIELD, P., Magnesium alloys for fuel, 16: 21076
GREENLAW, Robert H., Retention of Neohydrin-Hg-203, 16: 20113
GREENLEES, G. W., Polarization of protons scattered from Cu, 16: 21544
GREENSPAN, H. P., Flow of viscous electrically conducting fluid, 16: 20611
GREGL, A., Mammary hypoplasia after irradiation, 16: 20170
GREGSON, T. C., Radioisotope product dating, 16: 20909 (TID-15034)
GREINER, E., 1-Mv cascade generator, 16: 21655
GRENS, Albert F., Emissivity of graphites at elevated temperatures, 16: 21042 (WAL-TR-851.2/1)
GRIFFITH, T. C., Fast neutrons from p-d collisions, 16: 21475
GRIFFITHS, G. M., $O^{18}(p,\gamma)F^{19}$ direct radiative capture, 16: 21453
GRIFFITHS, R. J., Solid-state ionization chamber, 16: 20749
GRIGGS, B., Zirconium oxide corrosion product, 16: 20979 (HW-71958-RD)
GRIGOROV, N. L., Ionization pulses of cosmic radiation, 16: 21249
GRINBERG, G. A., Flow of conducting fluid along tube in magnetic field, 16: 20599 (FTD-TT-62-298)
GRODEN, C. M., Stability in chain reactions, 16: 21259
GROGLER, H., Bibliography on thermoluminescence, 16: 21133 (TID-3911)
GROLL, H., Criticality of U^{235}-impregnated cellulose, 16: 21258
GROSS, P., Heats of formation of Nb and Ta pentabromides, 16: 20450
GROSSART, J., Transformers with radiation detectors, 16: 20789
GROSSETETE, B., Electro- and photodisintegration of O-16, 16: 21377
GROSSMANN, S., Quantum-mechanical ergodicity conditions, 16: 21172
GROSSWEINER, L. I., Photoequilibrium between KCl F and F^{+} centers, 16: 21193
GROSVENOR, D., Reactor decontamination, 16: 20303 (ANL-6477(p.224-30))
GROTOWSKI, K. A., Polarization of protons scattered from Cu, 16: 21544
GROVER, George M., Direct transformation of thermal energy to electrical energy, 16: 21140 (AEC-tr-5048)
GROVER, J. Robb, Reactions of Ta with protons, 16: 21424
GRUBER, L., Radioactive fertilizers. I. phosphates, 16: 20475 (CEA-tr-X-434)
GRUNE, Werner N., Determination of radioactivity in water, 16: 20901
GRUSHA, O. V., Radiophosphorus in diagnosis of neoplasms, 16: 20073
GRUVERMAN, I. J., Activation analysis of chicken, 16: 20337
GRYNBERG, M., Four pion wave functions, 16: 21319
GUENTHER, Helge L., Sensitivity to uv of *Streptococcus faecalis*, 16: 20151
GUENTHER, R. A., Specific heat of Dy, 16: 21190
GUENTHER, W. S., Loop for electron irradiation of liquids, 16: 20487
GUERNSEY, Ralph L., Kinetic theory of quantum plasmas, 16: 21664 (DI-82-0155)
GUIDOBONI, E. S., Prog. rpt. on Ta extrusion, 16: 20992 (ASD-TR-7-783 (III))
GUILLEUX, Robert, Composition of a gaseous medium, 16: 20695
GUILLON, H., Automatic electronic switch, 16: 20773
GUILLON, H., Binary number comparator, 16: 20767
GUILLON, H., Intermediate arithmetic memory, 16: 20768
GUITTON, J., Single-channel transistorized selector, 16: 20790
GULIAKIN, I. V., Accumulation of fission products in crops, 16: 20885
GULIAKIN, I. V., Organic matter, soil composition, and fission uptake, 16: 20886
GUNDERSEN, Roy M., Hydromagnetic flow with transverse magnetic field, 16: 21117 (AD-269326)
GUNNERSEN, E. M., Properties of solid-state detectors, 16: 20750
GUPPY, C. B., Complex frequency testing, 16: 21118 (AEEW-M-220)
GUPTA, J. B., Neutron scattering cross sections in Pb isotopes, 16: 21545
GUPTA, K. K., Energy levels of iodine isotopes, 16: 21525
GURNER, John Raymond, Detecting particles in a gas stream, 16: 21776
GUSAKOW, M., Excitation functions for (p,pn) reactions, 16: 21484
GUSAKOW, M., Excitation functions for (p,xn) on gold, 16: 21485
GUST, William H., Emission characteristics of Ta, W, Re, Ir in plasma diodes, 16: 21138 (UCRL-6809)
GUTH, Eugene, Photodisintegration below the giant resonance. I and II., 16: 21585
GUTSCHE, G., Reaction $C^{13}(t,\alpha)B^{11}$, 16: 21569
GYOERKEY, Ferenc, Effect of radiation on serum activity level, 16: 20258

H

HABASHI, Fathi, Chemical analysis of monazite sand, 16: 20343
HACKNEY, Stanley, Improvements in reactors, 16: 21745
HADLEY, D. W., Electron pairs from π^{-} mesons, 16: 21315
HAHN, Harry, Nitrides of metals, 16: 20379 (UCRL-Trans-817)
HAINES, Geoffrey Herbert, Improvements in welded structures, 16: 21778
HAINS, F. D., Interaction of plasma jet with magnetic field, 16: 20619
HALAWANI, A., Iodine-131 in sheep and cattle thyroids in Egypt, 16: 20125
HALBERT, E. C., Distorted-waves calculation of direct reactions, 16: 21579
HALBERT, M. L., Angular momentum effects in nuclear evaporation, 16: 21625
HALBERT, M. L., Single-nucleon reactions induced by 28-Mev N-14 ions, 16: 21575
HALBERT, M. L., Surface-barrier counters, 16: 20744
HALE, C. E., Thermometer for thermocouple calibration, 16: 20646 (TRG-Report-261)
HALEVY, E., Determination of aquifer parameters, 16: 20840
HALL, D. J., Muon and pion capture in He-3, 16: 21384
HALL, E. J., Reproductive integrity of cells exposed to radiation, 16: 20154
HALL, E. J., X-ray dose-response relationship, 16: 20153
HALL, E. O., Radiation damage of mild steel, 16: 21100
HALL, W. S., Coulomb-distorted (d,p) angular distributions, 16: 21580
HALLECK, M. C., Calibration of P102 nuclear sensors, 16: 20632 (DC-59-6-743)
HALLER, J., Potassium–Ar ages on rocks, 16: 20845
HALNAN, K. E., Radiation skin reaction, 16: 20155
HALPERN, Francis R., Canonical transformations in quantum mechanics, 16: 21162
HALTON, J. H., Distorted-wave calculations of $Li^{6}(d,p)Li^{7}$, 16: 21596
HAMADA, Masayuki, Design of tracer laboratory, 16: 20568
HAMAGUCHI, Hiroshi, Trace elements in G-1 and W-1. II., 16: 20830
HAMASHIMA, Masami, Leukemia of Nagasaki atomic bomb survivors, 16: 20251
HAMBURGER, E. W., Neutron levels in the Zr region, 16: 21495
HAMEKA, H. F., Theory of magnetic rotation spectra, 16: 21159
HAMILTON, G. N., Reactivity coefficients in UO_2–D_2O two-region lattice, 16: 21716 (CVNA-114)
HANDWERK, J. H., Sintering study of thoria, 16: 20529
HANKINS, D. M., Cratering experiments in desert alluvium, 16: 20049 (SC-4596(RR))
HANKINS, Dale E., Thermal calibration of converted PeeWee neutron survey instrument, 16: 20640 (LAMS-2697)
HANNA, A. Z., Hazards in radiodiagnosis, 16: 20892
HANNA, G. L., Solid state reactions between fuel materials, 16: 20964
HANNA, S. S., Nuclear properties by Mössbauer effect, 16: 21447
HANSBURY, E., Radiocarbon in plant products, 16: 20079
HANSEN, E. C., Gross fission product poisoning, 16: 21814 (KAPL-M-ECH-8)
HANSEN, O., Collective character of 2.33-Mev state in Sn-116, 16: 21499
HANSEN, W. L., Energy resolution in detectors, 16: 20756
HARADA, Y., Sintering study of thoria, 16: 20529
HARDER, D., Film photographic techniques, 16: 20087
HARDER, D., Telecobalt field control, 16: 20088
HARDWICK, T. J., Loop for electron irradiation of liquids, 16: 20487
HARDY, D. R., Irradiation of small sphere gaps, 16: 20571
HARDY, J. R., Temperature control of irradiations, 16: 20572

HARIMA, T., Sides of a nuclear-powered ship, 16: 20573
HARLEN, Frank, Precipitation of particles from gases, 16: 20581
HARLEN, Frank, Precipitation of fission products from gases, 16: 21782
HARLOW, Francis H., Interaction of shock or rarefaction with a bubble, 16: 20608
HARRIS, Gordon M., Isotope applications in chemical kinetics, 16: 20361 (TID-15788)
HARRIS, L. A., Mixed oxide compounds containing BeO, 16: 20381
HARRIS, Susanne, Transfer of rabbit lymph node cells, 16: 20275
HARRIS, T. H., Transfer of rabbit lymph node cells, 16: 20275
HARRIS, V. A., Cratering experiments in desert alluvium, 16: 20049 (SC-4596(RR))
HARRISON, G. E., Availability to man of Sr in milk, 16: 20899
HART, W., Electron pairs from π^- mesons, 16: 21315
HARTIN, William J., Reactor control, 16: 21790
HARTKE, J. L., Drift mobilities and space-charge-limited currents in films, 16: 21018 (AFOSR-1416)
HARTWEG, H., Spleen and bone marrow in radiation reactions, 16: 20262
HASCHEMEYER, Ruby H., Dehydration of formic acid, 16: 20398
HASKIN, Larry, Rare-earth distribution in sediments, 16: 20841
HASTED, J. B., Ionization of atoms by protons, 16: 21218
HATCH, E. N., E1 transition probabilities in deformed odd-A nuclei, 16: 21458
HATZOPOULOS, E., Measurement of I-131 in irradiated Te, 16: 20489
HAUGLAND, George Torolf, Boron steel for reactor thermal shielding, 16: 21034 (HW-SA-2583)
HAUSER, U., E1 transition probabilities in deformed odd-A nuclei, 16: 21458
HAWKES, P. W., Electron beam cross sections, 16: 21155
HAWTHORNE, M. Frederick, Electrophilic D exchange reaction, 16: 20397
HAYES, A. F., Prog. rpt. on Be forging, 16: 20991 (ASD-TR-7-647(VI))
HAYES, F. N., Radiocarbon in plant products, 16: 20079
HAYMAN, C., Heats of formation of Nb and Ta pentabromides, 16: 20450
HAYON, E., Radiation chemistry of water, 16: 20505
HAYWARD, R. W., Relativistic matrix elements and nuclear potentials, 16: 21613
HEAD, Arthur John, Improved phosphorylated cellulose, 16: 20311
HEASTON, J. R., Cratering experiments in desert alluvium, 16: 20049 (SC-4596(RR))
HEATH, Russell L., Determination of K shell conversion coefficients, 16: 21134 (TID-15639)
HECKEL, Edgar, Radiation reactions of polyvinyl acetates, 16: 20501
HEDRICK, T. I., Removal of radioactive soil, 16: 20071
HEERSCHAP, M., Characteristics of SiC diodes, 16: 20751
HEIKEN, Aago, Somatic changes in *Solanum tuberosum*, 16: 20177
HEILER, J. H., Pulse characteristics of phototubes, 16: 21437
HEINIGER, J. P., Radioinduced formate oxidation, 16: 20485
HEINRICH, J. T., Solid-state detectors, 16: 20747
HEINZE, E., Electron beam welding, 16: 21000
HEISKELL, R. H., Water transport of particulate matter, 16: 20594 (USNRDL-TR-436)
HEKHUIS, Gerrit L., Effects of ionizing radiation, 16: 20243
HELLER, Carl A., Excited ethane and ethyl radicals, 16: 20408
HELLIWELL, J. B., Magnetogasdynamic shock waves, 16: 21178 (HPR-21)
HELLSTEN, A., Experiments with HBWR first fuel charge, 16: 21813
HEMMER, Per Chr., Nuclear rotational spectra, 16: 21386
HENDERSON, T. M., Neutron yields from 32-Mev protons, 16: 21479
HENDERSON, W. B., Bare reactor analysis, 16: 21728 (XDC-60-1-211)
HENGLEIN, Arnim, Radiation reactions of polyvinyl acetates, 16: 20501
HENRIKSON, H. E., Diffraction monochromator for study of nuclear resonance excitation, 16: 21443
HENRY, J., Case of late radionecrosis, 16: 20184
HERASYMENKO, Polykarp, Electrolytic refinement of metals, 16: 20969
HERBER, R. H., Iron-57 Mossbauer resonance, 16: 20404
HERBERT, D. N., Survey of (F-19, F-18) neutron transfer reactions, 16: 21428
HERBERT, Roy, Future for fast reactors, 16: 21831
HERION, J. C., Leukocyte kinetics, 16: 20062
HERLING, G. H., Theory of transfer reactions, 16: 21555
HERMAN, M., Prog. rpt. on high-purity Be, 16: 20958 (NP-11702)
HERZ, Jakob, Radiochemical polymerization of polymethylmethacrylate with acrylonitrile, 16: 20502
HESKETH, R. V., Dislocation loops in Cu during irradiation, 16: 21104
HESLOP, J. A. B., Activation analysis of light elements, 16: 20321 (NP-11608)
HESS, W. N., Neutron leakage and N_2 abundance of Venus, 16: 21228
HETHERINGTON, A., Quenching in liquid scintillators, 16: 21158
HEUSINKVELD, M., Stress history measurements at Gnome, 16: 20808 (PNE-105P)
HEYDA, J. F., Balanced reverse folded flow study, 16: 20595 (XDC-60-1-158)
HEYDA, James F., Hyperbolic equations with constant coefficients, 16: 20943
HILDENBRAND, G., Siemens Training Reactor SUR, 16: 21840
HILDINGER, M., Hemoglobin formation in chick embryo, 16: 20260
HILL, D. A., Cylindrical spark counter, 16: 20731
HILL, D. A., Image-intensifier system, 16: 20720
HILL, D. K., Resolving power with H-3 autoradiographs, 16: 20508
HILL, David C., Phase relations in UO–La_2O_3, 16: 20393
HINDS, S., Energy levels of O-18, O-20, F-21, and Na-25, 16: 21627
HINDS, S., Evidence for (21 + 1) rule, 16: 21515
HINDS, S., Reaction $Mg^{24}(d,p)Mg^{25}$, 16: 21592
HINDS, S., Reaction $B^{10}(d,p)B^{11}$ at 10.1 Mev, 16: 21593
HINTZ, N. M., Determination of parity change, 16: 21556
HIRSHMAN, R. S., Strontium-90 assay of environmental materials, 16: 20870 (NYO-9934(Vol.III)Ext.)
HIRST, L. L., Lectures on scattering theory, 16: 21260 (AFOSR-2409)
HISE, D. R., Performance of Ti in chemical plants, 16: 20983
HITCHCOCK, A., Properties of solid-state detectors, 16: 20750
HO, Tse-yun, Investigation on manufacture of portable Geiger counter, 16: 20666
HOBITZ, Helmut, Biological effects of radiation, 16: 20142
HODGSON, P. E., Distorted-wave analysis of (d,pγ) reactions, 16: 21553
HODGSON, P. E., Distorted-wave calculations of $Li^7(d,p)Li^8$, 16: 21596
HODGSON, P. E., Optical model analyses of nuclear surface, 16: 21529
HODGSON, P. E., Optical model analyses of He-3 scattering, 16: 21538
HODGSON, P. E., Optical model analysis of polarization in neutron scattering, 16: 21539
HOECKER, Frank E., Prog. rpt. on radiation polymerization dosimetry, 16: 20857 (AD-265757)
HOEHNE, P., Siemens Training Reactor SUR, 16: 21840
HOERLIN, Bettina, Bibliography on perturbation effects in EM cavity resonators, 16: 21652 (TID-15417)
HOFMANN, Dieter, Biological effects of electron irradiation, 16: 20224
HOGARTH, J. E., Absorber theory of radiation, 16: 21237
HOLADAY, Duncan A., Hazards to health in U mining and milling, 16: 20893
HOLLANDER, J. M., Prog. rpt. on chemistry, 16: 20305 (UCRL-10023)
HOLMES, J. J., Creep of Zy-2, 16: 21033 (HW-70151)
HOLMGREN, H. D., Angular correlations in $B^{10}(He^3,py)C^{12}$, 16: 21568
HOLMGREN, H. D., Cluster effects in nuclear reactions, 16: 21572
HOLMGREN, H. D., Reactions $Li^6(t,d)Li^7$ and $B^{10}(t,d)B^{11}$, 16: 21567
HOLMGREN, H. D., Reaction $C^{13}(t,\alpha)B^{11}$, 16: 21569
HOLMGREN, H. D., Reaction $Li^7(t,\alpha)He^6$, 16: 21570
HOLMGREN, H. D., Reaction $C^{13}(He^3,\alpha\gamma)C^{12}$, 16: 21571
HOLTZ, F. C., Prog. rpt. on Zr alloys, 16: 20973 (ARF-2198-18)
HOLZER, F., Stress history measurements at Gnome, 16: 20808 (PNE-105P)
HONEKAMP, J. R., Packing in a Scheibel extractor, 16: 20547
HONEYCOMBE, R. W. K., Thermal cycling of Zr, 16: 21059
HOOD, R. R., Prog. rpt. on heavy water reactors, 16: 21810 (DP-725)
HOOGENBOOM, A. M., Analysis of the $I_0 = 1$ groups in $Cl^{34}(d,p)Cl^{35}$, 16: 21594
HOOKER, R. J., Compact power plants, 16: 20558 (AD-269397)
HOOPES, John W., Jr., Advances in chemical engineering. II., 16: 20312
HOOVER, D. B., Prog. rpt. on high-purity Be, 16: 20958 (NP-11702)
HOPKINS, Shirley Russell, Means for shutting down reactors, 16: 21755
HOPPES, D. D., Relativistic matrix elements and nuclear potentials, 16: 21613
HORI, Jun-ichi, Long-time behavior of random lattice, 16: 21168
HORN, G., Memorizing circuit for long pulses, 16: 20804
HORNING, Wendell A., Control method and apparatus, 16: 21787
HOSKINS, Elizabeth L., Prog. rpt. on analytical techniques, 16: 20324

(TID-15661)
HOSTE, J., Gamma spectrometry and Compton effect, 16: 20673
HOTCHIN, John, Lymphocytic choriomeningitis in mice. I., 16: 20271
HOTCHIN, John, Lymphocytic choriomeningitis in mice. II., 16: 20272
HOTZ, G., Protective effects of cysteine and cysteamine, 16: 20293
HOTZ, G., Protective effects of cysteamine and glycerine, 16: 20294
HOULE, M. C., Ceramographic techniques. I., 16: 21052
HOUTERMANS, H., Calibration of nuclides, 16: 20667
HOVIS, W. A., Jr., Spectra of rare-earth ions, 16: 20430
HOWARD, James M., The Resistojet, 16: 21153
HOWARD, Rudolph G., Rats infected with *Trichinella spiralis* larvae, 16: 20137
HOWE, L. M., Radiation damage in Zr, Zy-2, 410 stainless steel, 16: 21086 (AECL-1484)
HOWLAND, L. P., Quantum theory of many-particle systems, 16: 21223
HRYNKIEWICZ, A. Z., Attenuation of Te-181 133-482 kev cascade, 16: 21350 (NP-11602)
HRYNKIEWICZ, A. Z., g-Factor of state of Te-181, 16: 21414
HSIH, Yuan-shu, Study of fall-out in Taiwan, 16: 20664
HSU, Tung-hung, Yield and distribution of neutrons from Zr–T target, 16: 21371
HSU, Yuan-chi, Cockcroft-Walton accelerator as neutron source, 16: 21654
HSU, Yuan-chi, Production of D_2O by electrolytic method, 16: 20926
HSU, Yuan-chi, Yield and distribution of neutrons from Zr–T target, 16: 21371
HUANG, Chung-hwa, Radiation production of heritable changes in rice, 16: 20180
HUBBARD, W. N., Calorimetry, 16: 20299 (ANL-6477(p.155-67))
HUBERY, R. W., Corrosion of alloy steels, 16: 20986
HUDSON, R. L., Dissociation of H peroxide by electron impact, 16: 20410
HUDSON, R. L., Mass spectrometry of the HO_2 free radical, 16: 20339
HUET, Andre, Controlling the reactivity of a reactor, 16: 21763
HUET, Andre, Controlling a nuclear reactor, 16: 21764
HUET, Andre, Improvements in reactors, 16: 21780
HUGENHOLTZ, N. M., Quantum theory of many-particle systems, 16: 21223
HUGHES, W. F., MHD journal bearing, 16: 20570
HUGOLIN, L., Single-channel transistorized selector, 16: 20790
HULL, D. E., River flow measurements, 16: 20836
HULL, M. H., Jr., Nucleon-nucleon interaction, 16: 21473
HUMMEL, Dieter, Radiochemical polymerization of polymethylmethacrylate with acrylonitrile, 16: 20502
HUNDESHAGEN, H., Emission of H-3 from illuminants, 16: 21367
HUNTING, C. E., Angular momentum effects in nuclear evaporation, 16: 21625
HUNTINGTON, C. W., Hydrogen reduction of U oxides, 16: 20528
HUNTINGTON, Morgan G., Nuclear fuel elements, 16: 21005
HURE, J., Corrosion of Zy by H_2O or steam, 16: 20985
HUTCHINSON, Franklin, Interaction of primary cosmic rays, 16: 20239
HYLLERAAS, Egil A., Representation of spinors, 16: 21708

I

IACI, G., Positron annihilation in water, 16: 21175
ICHIMURA, Michito, Leukemia of Nagasaki atomic bomb survivors, 16: 20251
IGNAT'EV, K. G., Multichannel time analyzer, 16: 20780
ILAKOVAC, K., Angular distributions from reaction $V^{51}(n,d)Ti^{50}$, 16: 21554
ILAKOVAC, K., Scattering length (n-a) from D(n,p)2n, 16: 21472
ILBERY, P. L. T., Adaptation of mouse bone marrow, 16: 20282
INGRAM, A. G., Tensile properties of binary Ti–Zr and Ti–Hf alloys, 16: 21058
INOUE, Shosuke, Formation of $UC_{1-x}O_x$, 16: 21050 (NP-tr-901)
INSAR, G., Transistor-driven decade counter tubes, 16: 20801
INGALLS, R. B., Temperature control of irradiations, 16: 20572
IORI, I., Cross section of $Si^{28}(n,a)Mg^{25}$, 16: 21413
IREDALE, P., Response of NaI(Tl) to γ rays, 16: 20713
ISADOR, P., Uterine endometrium following Ra therapy, 16: 20158
ISBIN, H. S., Two-phase flow through an aperture, 16: 20615
ISHIDA, Yoichi, Grain boundary sliding in Al and its alloys, 16: 21024 (ASD-TR-61-383)
ISHIYAMA, Toshio, Radiochemical waste evaporator system, 16: 21861
ISHIYAMA, Toshio, Treatment of radioactive waste, 16: 21862
ISOMAEKI, A. M., Skin of the frog after irradiation, 16: 20134
ISOYA, A., Proton polarization in deuteron stripping at 15 Mev, 16: 21597
ITO, Riosuke, Nonobstructive electron beam monitor, 16: 20653
ITO, Sadato, Lung cancer among atomic bomb survivors. I., 16: 20266
IUGA, C., Influence of radiation on treatment of trypanosomiasis, 16: 20256
IVANOV, A. E., Changes in lungs in radiation injuries, 16: 20228
IVANOVA, K. S., Determination of Th, Ra, and Pb in monazites, 16: 20325 (NP-tr-895)

J

JACKSON, Daphne F., Cluster and shell models for Li-6, 16: 21429
JACKSON, Daphne F., Wave distortion in direct interactions, 16: 21591
JACKSON, George Oliver, Improvements in reactors, 16: 21768
JACMART, J. C., Momentum distribution of protons in C-12 nucleus, 16: 21489
JACOB, Gerhard, Shell structure study by electron scattering, 16: 21471
JACOBSEN, T., Measurements of jets, 16: 20681
JAGGI, R. K., Wave motion in plasma with anisotropic pressure, 16: 21665 (NP-11649)
JAIN, B. D., Determination of Th with rutin, 16: 20427
JAIN, P. L., Analysis of α-particle interaction, 16: 21404
JAIN, P. L., Meson-nucleon interaction, 16: 21308
JAMES, M. F., Sodium reactivity effects in dilute fast reactor, 16: 21711 (AEEW-M-225)
JANAUER, G. E., Determination of U(IV, VI), 16: 20348
JANSEN, R. J., Hot rotary forging of U tubing, 16: 20993 (NLCO-842)
JARRETT, A. H., Physics of upper atmosphere, 16: 21121 (AFCRL-1062-I)
JARRY, R. L., Fuel cycle applications of volatility and fluidization techniques, 16: 20298 (ANL-6477(p.106-54))
JASEJA, Thadho S., Radiation damage in dl-aspartic acid, 16: 20496
JASTRAM, P. S., Gamma cascades in Pb-208, 16: 21392
JAUCH, Josef M., Foundations of quaternion quantum mechanics, 16: 21161
JAYARAMAN, A., Fusion curve of Cs, 16: 21191
JEDRUCH, J., Reactivity coefficients in UO_2–D_2O two-region lattice, 16: 21716 (CVNA-114)
JEHANNO, C., Windowless photomultipliers, 16: 20724
JENKINS, I. L., Amines in inorganic hydrolysis, 16: 20434
JERKINS, Ernest Edward, Improvements in reactors, 16: 21750
JERKINS, Ernest Edward, Improvements in reactors, 16: 21758
JERKINS, Ernest Edward, Nuclear reactor refueling machines, 16: 21754
JERONYMO, J. M. F., Excitation functions of $V^{51}(p,n\gamma)Cr^{51}$, 16: 21626
JEZOWSKA-TRZEBIATOWSKA, B., Absorption spectra of uranyl compounds, 16: 20449
JOHANSSON, B., Deflection method for measuring short half lives, 16: 21438
JOHANSSON, N. G. E., Instrumentation for pulse spectroscopy, 16: 20753
JOHN, R. R., Arcjet-propelled spacecraft, 16: 21854
JOHNSON, A. A., Ductile-brittle transition in transition metals, 16: 21068
JOHNSON, C. E., Electric quadrupole moment of Fe-57, 16: 21418
JOHNSON, C. M. P., Polarization in π^-–p scattering, 16: 21323
JOHNSON, Irving, Thermodynamics of U–Cd system, 16: 21070
JOHNSON, R. C., Polarization correlation in direct reactions, 16: 21590
JOHNSON, R. C., Proton spin-orbit distortion in (d,p) reaction, 16: 21599
JOHNSON, R. C., Spin-dependent distortion in direct reactions, 16: 21600
JOHNSON, R. G., Reaction $C^{14}(He^3,n_0)O^{16}$ and $C^{14}(He^3,n_0)O^{16}$, 16: 21595
JOHNSON, R. H., Thermal cycling of Zr, 16: 21059
JOHNSON, Simon H., Method for handling radioactive source, 16: 20586
JOHNSON, W. C., Jr., Equilibrium properties of H_2, 16: 21177
JOHNSON, W. P., Polarization measurement of (d,p) reactions, 16: 21581
JOHNSON, W. R., Continuum Coulomb wave function, 16: 21165
JOHNSTON, R. L., Angular correlations in $B^{10}(He^3,p\gamma)C^{12}$, 16: 21568
JOLLY, William L., Exchange of D with solid K hydroborate, 16: 20401
JONES, James T., Effect of irradiation on healing of wounds in albino rat, 16: 20289
JONES, L. W., Luminescent chamber, 16: 20722
JONES, R., Neutral particles in 30° beam from AGS, 16: 21650 (NP-11624)
JORDAN, Asa J., Space environment and its interactions with propellants, 16: 21845 (AD-266034)

JORDAN, C. B., Prog. rpt. on quenching metallic systems, 16: 21011 (AD-264988)
JORDAN, C. B., Prog. rpt. on semiconductors for thermoelectric power generation, 16: 21112 (AD-266009)
JORDAN, P., Determination of D in H_2O, 16: 20333
JOUIN, Jacques, Manipulating apparatus, 16: 20582
JOVICKI, G., Recovery effect of liver DNA injected into irradiated rats, 16: 20283
JUDD, J. M., Absorption of Sr-90 by fish, 16: 20106
JULKE, R. T., Measurement of energy and intensity of γ rays, 16: 20628 (ANL-6499)
JULLIOT, C., Windowless photomultipliers, 16: 20724
JUNG-KOENIG, W., Prog. rpt. on Zr–Nb alloys, 16: 20981 (EURAEC-27)
JUNG-KOENIG, W., Prog. rpt. on Zr–Nb alloys, 16: 20982 (EURAEC-85)
JUSTHEIM, Clarence I., Nuclear fuel elements, 16: 21005
JUUL, H., Prog. rpt. on properties of carbons and graphites, 16: 21038 (NP-11665)
JUZA, Robert, Nitrides of metals, 16: 20379 (UCRL-Trans-817)

K

KAELD, L., Gamma-γ directional correlations in Pb-208, 16: 21635
KAFKAFI, Uzi, Placing of radioactive solution in soil, 16: 20850
KAGEURA, Naomi, Blood picture of Nagasaki survivors, 16: 20248
KALAB, B., Filling gas for counters, 16: 20668
KALLMANN, Hartmut, Prog. rpt. on solid state radiation-induced phenomena, 16: 20470 (NP-11604)
KALLMANN, Hartmut P., Energy transfer in radiation chemistry, 16: 20510
KALOS, M. H., Monte Carlo calculations of α particle ground state, 16: 21537
KALYAMIN, A. V., Ion exchange separation of rare-earth elements, 16: 20371 (AEC-tr-4457(p.187-9))
KALYUZHNII, I. T., Iodine-131 for studies of thyroid function, 16: 20100
KAMEYANA, Yoshiro, Radiation malformations in the mouse fetus, 16: 20187
KAMINSKY, Manfred, Sputtering experiments, 16: 21183
KAMISS, Charles B., Flexible protective plastic shield, 16: 20587
KAMKE, D., Three alpha particle break-up of C^{12*}, 16: 21637
KAMOCHI, Yasuro, Leukemia of Nagasaki atomic bomb survivors, 16: 20251
KANAZAWA, Tomotsu, Radioactivation of In-115, 16: 21366
KANAZIR, D., Recovery effect of liver DNA injected into irradiated rats, 16: 20283
KANDA, Frank A., Prog. rpt. on specific volumes of liquid metals, 16: 21041 (TID-15663)
KANDIAH, K., Pulse-height discriminator, 16: 20782
KANDIAH, K., Reducing errors in converters, 16: 20759
KANDROR, V. I., Changes of adrenal medullary layer during irradiation, 16: 20191
KANE, W. R., Properties of collective states in Os-186, 16: 21461
KANELLAKOS, D. P., Solar flare of September 28, 1961, 16: 21233
KANGAS, Seppo, Radiation response in patients, 16: 20057
KANSKY, E., Development of photomultiplier, 16: 20727
KAPLAN, G. E., Thorium mineral resources, 16: 20852
KAPLUNOV, M. Ya., Radiation vulcanization, 16: 20481
KAPOOR, S. S., Angular distribution of fission fragments, 16: 20736
KARINO, Takashi, Radiochemical waste evaporator system, 16: 21861
KARINO, Takashi, Treatment of radioactive waste, 16: 21862
KARPOV, V. L., Effect of radiation on polyethylene insulation, 16: 20518
KARRIKER, F. P., Isotopic history tracer, 16: 20935 (XDC-60-3-211)
KARTUSHOVA, R. E., Stability constants of $Ce(NO_3)_x$ ions, 16: 20370 (AEC-tr-4457(p.167-82))
KASHY, E., Analysis of the $I_n = 1$ groups in $Cl^{34}(d,p)Cl^{36}$, 16: 21594
KASTENBAUM, Marvin A., Radiosensitivity of spleen cells, 16: 20274
KATAYAMA, Mikio, Gamma-irradiated acetyl-d,l-alanine, 16: 20513
KATOH, Toshio, Study of Cd isotopes. I., 16: 21380
KATOH, Toshio, Study of Cd isotopes. II., 16: 21381
KAUFMANN, O. W., Renoval of radioactive soil, 16: 20071
KAUZLARICH, James J., Symposium on heat transfer, 16: 20613
KAVAI, Mario, Effect of x rays on guinea pig, 16: 20252
KAVALOSKI, C. D., Determination of parity change, 16: 21556
KAWABATA, Keisuke, Calorimeter for intense electron beams. I., 16: 20651
KAWAMATA, Shuichiro, Theta pinch device, 16: 21669
KEATEN, R. W., Fuel rod bowing in SRE, 16: 21722 (NAA-SR-6878)
KEIM, J. J., Design calculations for quick disconnects, 16: 20561 (DC-59-9-154)
KELLER, C., Separation of elements Ac to Am, 16: 20340
KELLER, Douglas V., Prog. rpt. on specific volumes of liquid metals, 16: 21041 (TID-15663)
KELLER, F. R., Fuel element flow blockage in ETR, 16: 21719 (IDO-16780)
KELLER, Joseph M., Anharmonic contributions to specific heat, 16: 2118
KELLER, Wayne Hicks, Concentration of Zr nitrate solutions, 16: 20465
KELLNER, H., Yvon approximation method. II., 16: 21336
KEMBER, Norman Frank, Improved phosphorylated cellulose, 16: 20311
KEMP, M. A. R., Nuclear capture of polarized muons, 16: 21426
KEMPTER, C. P., Properties of ThC and ThC_2, 16: 21060
KENDALL, B. R. F., Time-of-flight mass spectrometer, 16: 20670
KENDALL, H. W., Electron scattering from discrete nuclear levels, 16: 21450
KENNEDY, G. C., Fusion curve of Cs, 16: 21191
KENT, Ivor, Improvements in fuel elements, 16: 21771
KENTY, Carl, Characteristics of positive column, 16: 21179
KEPP, Richard K., Biological effects of electron irradiation, 16: 20224
KEPPELER, R. A., Renoval of radioactive soil, 16: 20071
KERMAN, A. K., Scattering of high-energy deuterons from nuclei, 16: 21467
KERN, J. W., Preliminary reverse impulse of storms, 16: 21229
KERN, Walter P., Control for sample changing, 16: 20700
KERR, V. N., Radiocarbon in plant products, 16: 20079
KESSLER, H. D., Prog. rpt. on Ti sheet rolling program, 16: 21009 (AD-264815)
KESZTHELYI, Bela, Blood volume in polycytheria vera and treatment with P-32, 16: 20117
KHANNA, F. C., Cluster model calculations in light nuclei, 16: 21496
KHANOLKAR, V. R., Effects of ionizing radiations, 16: 20181
KHODZHAEVA, R. P., Thermal studies of U and U-bearing minerals, 16: 20853
KIEFFER, Jean, Emission source for continuous spectra, 16: 20448
KIEFFER, Richard, Radiation shield structures, 16: 21006
KIEFHABER, E., Neutron scattering on H_2O, 16: 21343
KIENY, Madeleine, Competition between anlage of tibia and fibula in chick embryo, 16: 20164
KIESEWETTER, H., Flux dosing as measurement of absorber rod efficiency. II., 16: 21740
KIKITSU, Yoshitane, Leukemia of Nagasaki atomic bomb survivors, 16: 20251
KING, D., Prog. rpt. on effects of radiation on pressure vessel steels, 16: 21090 (EURAEC-140)
KING, N. M., Nimrod external proton beam, 16: 21649 (NIRL/R/12)
KINGSTON, A. E., Recombination between electrons and ions. I., 16: 21683
KINSEY, E. L., Infrared-absorption spectra of LiOH and LiOD, 16: 20409
KIRICHINSKII, B. P., Aspects of radiobiology, 16: 20080
KIRKPATRICK, Craig G., Passivation of reactive metal surfaces, 16: 2097
KIRPICHNIKOV, I. V., Multichannel time analyzer, 16: 20780
KIRPICHNIKOV, I. V., Slow neutron scintillation counter, 16: 20718
KIRRMANN, J. M., Radioprotective phenomena in embryonic chick organ, 16: 20186
KIRSTEIN, P. T., Injection system for CERN storage ring model, 16: 21644 (CERN-62-4)
KIRYUSCHENKOV, A. P., Erythropoiesis in irradiated gravid animals, 16: 20190
KIRZSA, F., Thrombocytosis-producing action of serum of x-irradiated mice, 16: 20277
KISDI, D., Nuclear molecules of two C-12 nuclei, 16: 21220
KISELEV, V. F., Oxygenated complexes on the surface of graphite, 16: 20387
KISELEVA, E. S., Colloid Au in treatment of lung cancer, 16: 20099
KITTL, J., Beta transformations of Cu–Sn alloys, 16: 21040 (NP-11698)
KITTS, F. G., Darex Process, 16: 20536 (ORNL-2712)
KIVALO, E., Skin of the frog after irradiation, 16: 20134
KJELLMAN, J., Angular distributions from reaction $Li^7(\alpha,n)B^{10}$, 16: 21602

KLADNITSKAYA, E. (Ye.) N., Scattering of Λ and K^+_1 on H_2, 16: 21264 (JINR-D-820)

KLEINMAN, R. E., Interaction of EM fields with plasmas, 16: 21661 (AFCRL-746)

KLINGENBERG, E. W., Bare reactor analysis, 16: 21728 (XDC-60-1-211)

KLOHN H., Erik, Reconnaissance for U in Chile, 16: 20820 (RME-4568)

KLOKE, Adolf, Strontium-90, Cs-137, and Pu-239 in hay, 16: 20128

KLOUWEN, H. M., Irradiation effects on DNA, 16: 20193

KNABE, W., Theoretical hydromagnetic shocks, 16: 21662 (AFSWC-TDR-63-42)

KNAPP, Robert, Disappearance of Na-24 from uterine muscle, 16: 20116

KNIGHTS, Herbert Chilvers, Improvements in reactors, 16: 21750

KNIGHTS, Herbert Chilvers, Improvements in reactors, 16: 21758

KNIGHTS, Herbert Chilvers, Nuclear reactor refueling machines, 16: 21753

KNIGHTS, Herbert Chilvers, Nuclear reactor refueling machines, 16: 21754

KNIGHTS, Herbert Chilvers, Refueling machines for reactors, 16: 21748

KNIGHTS, Herbert Chilvers, Refueling machines for reactors, 16: 21749

KNIPPER, A. C., Nuclear lifetimes with time-to-height converter, 16: 21440

KNIPPER, Albert, Plane polarization of AcC'' γ rays, 16: 21369

KNISSEL, G., E1 transition probabilities in deformed odd-A nuclei, 16: 21458

KNITTER, H.-H., Radiative capture of deuterons in Be-9 and C-12, 16: 21638

KNOBEL, D. P., Maternal-fetal barrier in the mouse. II., 16: 20067

KNOX, Robert S., Ultraviolet absorption in rare gases, 16: 20417

KNUDSEN, R. F., Radioisotope displacement transducers, 16: 20913

KOBA, Z., Four pion wave functions, 16: 21319

KOBA, Ziro, Effective target mass, 16: 21271

KOCH, L., Potassium–Ar ages on rocks, 16: 20845

KOCH, L., Properties of silicon n-i-p junctions, 16: 20748

KOCH, P., Theoretical hydromagnetic shocks, 16: 21662 (AFSWC-TDR-63-42)

KOECHLIN, Y., Characteristics of the 56 AVP photomultiplier, 16: 20725

KOEHL, R., Prog. rpt. on radiacmeter research, 16: 20625 (AD-265927)

KOEHLER, D. R., Neutron partial cross section studies, 16: 21352 (NP-11667)

KOEHLER, H. S., Many-body problem of O-16, 16: 21542

KOEHLER, J. K., Variation of yeast ribosomes, 16: 20103

KOEH, J. W., Scattering of cosmic ray muons, 16: 21248

KOERTS, L. A. Ch., Automatic data-taking system, 16: 20778

KOERTS, L. A. Ch., Particle identification system, 16: 20799

KOESTER, L. J., Jr., Polarization in π–p scattering, 16: 21323

KOFSTAD, Per, Oxidation of Ta, 16: 21021 (ARL-240)

KOGA, Toyoki, Kinetic equations for plasmas, 16: 21676

KOK, Bessel, Radiation tolerances in photosynthesis, 16: 20238

KOLAR, J., Limb anomalies as radiation damage, 16: 20172

KOLB, Alan C., Rotation of plasmas in θ pinches, 16: 21681

KOLB, Klaus, Plastic deformation of sintered Ni, 16: 21081

KOLBANOVSKII, Yu. A., Transfer of energy in radiolysis, 16: 20491

KOLLMANN, K., Radioisotopes in mechanical engineering research, 16: 20916

KOLMANSON, A. E., Gamma-irradiated vinyl polymers, 16: 20486

KOLOGRIVOV, R., Potassium–Ar ages on rocks, 16: 20845

KOMAROV, E. V., Extraction of uranyl nitrate, 16: 20542 (TRG-Inf-Ser-42)

KOMODA, H., Detailed flow field in transition, 16: 20614

KONDAIAH, E., Interactions of fast neutrons with F, 16: 21549

KONDO, Masatsune, Polymerization of oxetanes by radiation, 16: 20503

KONIECZNA, Z., Attenuation of Ta-181 133-482 kev cascade, 16: 21350 (NP-11602)

KONRAD, M., Pulse-amplitude multipliers, 16: 20798

KONSTA, A., Discriminating scintillation shapes, 16: 20785

KOPFERMANN, H., Angular momentum quantum number of Ho-165, 16: 21379

KOPP, P. M., Radiation protection with sulfur compounds, 16: 20507

KORDYUK, R. A., System CaO–MgO–ZrO_2–SiO_2, 16: 21067

KORKISCH, J., Determination of U(IV, VI), 16: 20348

KORKISCH, J., Distribution of U(VI) between alcohol–nitric acid, 16: 20548

KORMAN, M., Transistor-driven decade counter tubes, 16: 20801

KOROVIN, S. S., Extraction of Zr and Hf, 16: 20545

KOROVKINA, A. V., Organic matter, soil composition, and fission uptake, 16: 20886

KOSHINO, Shigeharu, ESR of irradiated glasses, 16: 20476

KOSTIC, V. N., Logarithmic counting-rate meter, 16: 20803

KOSTIGEN, T. J., Beryllium neutron cross sections, 16: 21334 (DC-60-12-98)

KOVAC, B. J., Logarithmic counting-rate meter, 16: 20803

KOVALENKO, K. N., Mobility of the Th ion, 16: 20459

KOVASZNAY, L. S. G., Detailed flow field in transition, 16: 20614

KOVASZNAY, L. S. G., Sink flow in strong magnetic field, 16: 20609

Kovnatski, Ya.
see Kownacki, J.

KOWALSKI, Ludwik, CsI(Tl) as fission fragment detector, 16: 20669

KOWNACKI (KOVNATSKI), J. (Ya.), Radioactivity of slags used in building materials, 16: 20871 (PAN-269/I-A)

KOZINSKI, Andrzej W., Kinetics of parental DNA replication in *E. coli*, 16: 20095

KOZLOV, V. T., Radiation vulcanization, 16: 20481

KOZLOVA, A. V., Pathogenesis of radiation injuries of skin, 16: 20132 (JPRS-13644)

KOZLOVA, I. A., Effects of radiation on virus immunity, 16: 20227

KRAMER, J., Radiocesium in human diet, 16: 20856 (A/AC.82/G/L.746)

KRAMER, P., Three alpha particle break-up of C^{12}, 16: 21637

KRAPIVIN, M. I., Extraction of Pu(IV) with TBP, 16: 20369 (AEC-tr-4457 (p.161-6))

KRASHENINNIKOV, I. S., Measuring and recording system, 16: 20781

KRASNOV, K. S., Relationship between radius of undeformed "gaseous" ion and ionic properties, 16: 20365 (AEC-tr-4457(p.1-9))

KRAUS, H., Strain hardening in yielded compound cylinder, 16: 20965

KRAUS, Kurt A., Adsorption on inorganic materials. IV., 16: 20403

KREBS, K. H., Dissociation of H^+_3 and H^+_5 ions in accelerator, 16: 21656

KREMPL, H., Thermodynamic equilibrium in spark plasmas, 16: 21687

KRENZ, F. H., Effect of fluoride on corrosion of Zy-2, 16: 20977 (CRGM-1082)

KREPLIN, R. W., X-ray emission from the sun, 16: 21232

KREY, Philip W., Studies of nuclear debris in precipitation, 16: 20816 (NYO-9531)

KRIESTER, A., 1-Mv cascade generator, 16: 21655

KRIKORIAN, N. H., Properties of ThC and ThC_2, 16: 21060

KRISEMENT, Otto, Recovery and recrystallization of Ni, 16: 21082

KRIZSA, F., Action of x radiation on uv thrombopoietic factor, 16: 20290

KROGSTAD, Reuben S., Phase transformation in single-crystal $SrTiO_3$, 16: 21032 (D1-82-0163)

KROHN, V. E., Generation and acceleration of submicron particles, 16: 20567 (NP-11533)

KRUEGER, L., Decay of bound muons, 16: 21611

KRUGER, P., Activation analysis of chicken, 16: 20337

KRUMHOLZ, Powel, Process for separating ions, 16: 20554

KRZYWICKI, Andrzej, Effective target mass, 16: 21271

KSENOFONTOVA, R. F., Thermodynamics of W oxides, 16: 21055

KUAN, Hsia-min, Mechanism of reaction $C^{13}(He^3,n)^{15}$, 16: 21551

KUBIK, R. N., Calculation of neutron absorption in square lattice, 16: 21715 (BAW-154)

KUDRYASHOV, Yu. B., Toxic effect of oxidation products of oleic acid on yeast cells, 16: 20063

KUDRYASHOVA, O. I., Blood plasma in prolonged contact with radiation, 16: 20188

KUEHN, W., Measurement of mass per unit area, 16: 21170

KUEHNER, J. A., Deexcitation branching and radiative widths of Ne-20, 16: 21633

KUENKEL, Hans A., Radiation burden of cell nucleus, 16: 20222

KUESTERS, H., Neutron transport problem in fuel elements, 16: 21344

KUHLMAN, Carl W., Prog. rpt. on UO_2 powders, 16: 20961 (UNC-1001)

KUHNKE, E., Retraction acceleration after x irradiation, 16: 20205

KUKARIN, A. I., Cadmium sulfide γ-detectors, 16: 20663

KULESHOV, I. M., Atmospheric corrosion of "ARMCO" steel and carbon steel, 16: 21098

KULIKOVSKII, A. G., Shock waves in magnetohydrodynamics, 16: 21206

KULP, J. L., Potassium–Ar ages on rocks, 16: 20845

KUO, L. G., Angular distributions from reaction $V^{51}(n,d)Ti^{50}$, 16: 21554

KUO, L. G., Scattering length (n-n) from D(n,p)2n, 16: 21472

KUO, Tze-su, Photography of slow neutrons, 16: 20665

KURATA, Akinori, Study on women receiving irradiation on lower abdomen, 16: 20265
KURATH, Dieter, Enhancement of electromagnetic transition probabilities, 16: 21432
KURDJUMOV, G. V., Specific features of strengthened metals, 16: 21069
KURNICK, S. W., Prog. rpt. on radiation effects on Si solar cells, 16: 21092 (GACD-3001)
KUROCHKIN, S. S., Measuring and recording system, 16: 20781
KURODA, Rokuro, Trace elements in G-1 and W-1. II., 16: 20830
KUSCHKE, H. J., Adrenalin systems of rats after x irradiation, 16: 20173
KUSHELEV, Yu. V., Mobility of the Th ion, 16: 20459
KUTZ, W. P., Program for multiple lethargy level cell corrections for slab cells, 16: 21721 (MND-C-2500-2)
KUYPER, Ch. M. A., Radiation effects on cells, 16: 20204

L

LABBAUF, Abbes, Carbon-12 scale of atomic masses, 16: 20307
LABORIE, P., Sphere-plane type spark counters, 16: 20738
LA COUR CHRISTENSEN, P., Experiments with HBWR first fuel charge, 16: 21813 (HPR-21)
LAJTHA, L. G., X-ray dose-response relationship, 16: 20153
LAKEY, John Richard Angwin, Examining radioactive samples, 16: 20691
LAL, M., $O^{18}(p,\gamma)F^{19}$ direct radiative capture, 16: 21453
LALOVIC, B., Distribution of pile-neutron flux, 16: 20754
LANCMAN (LANTSMAN), H. (G.), Radioactivity of slags used in building materials, 16: 20871 (PAN-269/1-A)
LANDE, K., Image-intensifier system, 16: 20719
LANDESMAN, Robert, Disappearance of Na-24 from uterine muscle, 16: 20116
LANG, J., Photoneutrons from Be-9, 16: 21410
LANGENDORFF, Hans, Chronic radiation burden, 16: 20220
LANGENDORFF, Margarethe, Chronic radiation burden, 16: 20220
LANGEVIN, M., Resonant scattering of γ rays in giant resonance region, 16: 21456
LANGKAU, R., Interaction effects in (n,p) and (n,α) reactions in CsI, 16: 21552
LANGMUIR, David B., Electric spacecraft, 16: 21853
LAPIS, K., Hormones in x-ray-induced liver changes, 16: 20247
LARA, M., Ionization chamber for α-particle analysis, 16: 20643 (NP-11691)
LARDNER, R. W., General unitarity term, 16: 21702
LA SALLE, Joseph, Stability by Liapunov's direct method, 16: 20948
LASKOWSKI, Wolfgang, Inactivation research with homozygous yeast, 16: 20226
LASSILA, K. E., Nucleon-nucleon interaction, 16: 21473
LATARJET, Raymond, Radiochemical investigation of nucleic acids, 16: 20515
LAUBER, R., Stability investigation of reactors, 16: 21731
LAUFFER, Max A., Effect of uv irradiation on nucleic acid, 16: 20150
LAWRENCE, B. R., Solution of optimum design problems on digital computer, 16: 20555 (AAEC/E-85)
LAWRENCE, J. S., Studies with radioactive Au, 16: 20083
LAWRENCE, Pope A., Hazards to health in U mining and milling, 16: 20893
LAZAREVA, L. E., Inelastic nuclear scattering of photons, 16: 21641
LEADER, E., Low-energy nucleon-nucleon interaction, 16: 21480
LEADER, R. W., Effect of tumor materials on irradiated animals, 16: 20253
LEAF, A. C., Measurement of U burnup, 16: 20317 (HW-72199)
LE BLANC, Andre, Hypersonic plasma generator, 16: 21139 (UNM-TR-EE-73)
LECHNICK, W., Coolant radionuclide base levels for PWR Core I, Seed 2, 16: 21824 (WAPD-PWR-TE-89)
LECHOWICH, R. V., Radiation sterilization of food. II., 16: 20914
LECOMTE, J. L., Transistorized pulse-height discriminator, 16: 20797
LE COUSTEY, P., Delayed neutrons in "Proserpine", 16: 21739
LEDDICOTTE, G. W., Labeling the P of nucleotides, 16: 20494
LEDERER, M., Adsorption of UO_2^{++} on resin papers, 16: 20341
LEDINGHAM, K. W. D., The L/K-capture ratio of Ar-37, 16: 21408
LEE, A. R., Ionization of atoms by protons, 16: 21218
LEE, Calvin M., Labeling the P of nucleotides, 16: 20494
LEE, E. W., Magnetostriction of Dy metal, 16: 21214
LEE, L. L., Jr., Determination of parity change, 16: 21556
LE FLEM, Leon, Manipulating apparatus, 16: 20582
LEFSCHETZ, Solomon, Stability by Liapunov's direct method, 16: 20948
LEGGETT, R. D., Microstructure of U, 16: 20953 (HW-73476)
LE HAZIF, Roger, Diffusion and solubility of Fe in Be, 16: 21054
LEHNERT, B., Stabilization of flute disturbances, 16: 21680
LEIBNITZ, E., Purification of radioactive waste materials. III., 16: 21865
LEIFIELD, R. F., Production of U from U oxides, 16: 20527
LE LOUP, C., Delayed neutrons in "Proserpine", 16: 21739
LE MEE, J., Electron mobility in electric fields, 16: 21282
LEMESLE, Georges, Improvements relating to nuclear reactors, 16: 21760
LEMMON, Alexis W., Jr., Prog. rpt. on engineering properties of K, 16: 21839 (NP-11671)
LENCHEK, A. M., Low-energy geomagnetically trapped protons, 16: 21243
LENGEMANN, F. W., Strontium and Ca metabolism of bone, 16: 20064
LENK, R., Nuclear models and tensor of inertia, 16: 21503
LENNOX, C. G., Protective system design for reactors, 16: 21793 (AECL-1495)
LEONARD, Stanley L., Theta pinch experiments, 16: 21658 (AD-265829)
LEONT'EV, A. I., Turbulent air flow in axisymmetrical channels, 16: 20606
LEPESHKOVA, L. I., Preparation of pure Cs and Rb compounds, 16: 20389
LEPRINCE-RINGUET, Louis, Hyperons, 16: 21276
LES BAINS, Enghien, Manipulating apparatus, 16: 20583
LESSING, I. J., Scattering of cosmic ray muons, 16: 21248
LEUTNER, Hans W., Production of cyanogen, 16: 20392
LEVASSEUR, M., Fatigue of Zy-2, 16: 21065
LEVI, C., Excitation functions of $V^{51}(p,n\gamma)Cr^{51}$, 16: 21626
LEVI, D. L., Heats of formation of Nb and Ta pentabromides, 16: 20450
LEVIN, V. I., Obtaining carrier-free As-77 from irradiated Ge, 16: 20474 (CEA-tr-R-1476)
LEVINA, M. I., Uranyl ferrocyanides, 16: 20367 (AEC-tr-4457(p.69-79))
LEVINE, R. P., Mutant clones induced by uv in green algae, 16: 20203
LEVINE, Seymour, Effect of irradiation on poliovirus yield, 16: 20201
LEVINSON, C. A., Sakata model of unitary symmetry, 16: 21317
LEVITT, Albert P., Emissivity of graphites at elevated temperatures, 16: 21042 (WAL-TR-851.2/1)
LEVSHIN, V. L., Luminescence of crystalline substances, 16: 20376 (AEC-tr-5110)
LEVY, F., Elastic scattering of $\pi^+ + p$, 16: 21293
LEVY, Robert N., Therapy of multiple myeloma with Y-90, 16: 20070
LEWIS, C. R., Prog. rpt. on semiconductors for thermoelectric power generation, 16: 21111 (AD-265106)
LEWIS, J., Properties of halides of Ti and Zr, 16: 20423
LEWIS, P. S., Neutron yields from 32-Mev protons, 16: 21479
LEYT, A., Beta transformations of Cu–Sn alloys, 16: 21040 (NP-11698)
LEZHNEV, N. N., Oxygenated complexes on the surface of graphite, 16: 20387
LI, Heng-yueh, Investigation on manufacture of portable Geiger counter, 16: 20666
LI, K., Image-intensifier system, 16: 20720
LIAO, Ching-sen, Mutations induced by x rays in sweet potatoes, 16: 20178
LICK, R., Radiation-induced epithelial carcinoma in rat lung. I., 16: 20147
LICK, R., Radiation-induced epithelial carcinoma in rat lung. II., 16: 20148
LIEBECQ, C., Radiosensitivity of *Escherichia freundii*, 16: 20144
LIEBER, A. J., Proton angular distributions for (n,p) reactions, 16: 21417
LIEBSCHER, H., Fluorinating behavior of UO_2 powders, 16: 20432
LILOVA, O. M., Ion exchange separation of rare-earth elements, 16: 20371 (AEC-tr-4457(p.187-9))
LIN, S. H., Slip flow in parallel plate channel, 16: 20620
LINDELL, Bo, Assessments of radiation hazards, 16: 20898
LINDGREN, Ingvar, Nuclear magnetic moments in rare earth region, 16: 21388
LINDNER, R., Diffusion of fission product ions in UO_2, 16: 21046 (AEC-tr-5171)
LINGENFELTER, R. E., Neutron leakage and N_2 abundance of Venus, 16: 21228

LIPKAN, N. F., Aspects of radiobiology, 16: 20080
LIPKAN, N. F., Elements of radiation biochemistry, 16: 20120
LIPKIN, H. J., Many-body perturbation in soluble model, 16: 21512
LIPKIN, H. J., Models of many-particle systems, 16: 21502
LIPKIN, H. J., Sakata model of unitary symmetry, 16: 21317
LIPPERT, E., Action of radiation on endocrine processes, 16: 20291
LIPPINCOTT, E. R., Inorganic carbonates and nitrates, 16: 20416
LIPPMANN, Bernard A., Sommerfeld half-plane problem, 16: 20944
LISLE, J. C., Reaction $C^{13}(C^{13},\alpha)Ne^{20}$, 16: 21603
LITHERLAND, A. E., A2 assignment for 4.97-Mev level in Ne-20, 16: 21632
LITHERLAND, A. E., Evidence for (2I + 1) rule, 16: 21515
LITONJUA, Augusto D., Tagged red cell studies. I., 16: 20055
LITONJUA, Augusto D., Tagged red cell studies. II., 16: 20056
LITTLE, P. F., Ion waves in bounded plasma, 16: 21674
LITTLE, W. S., Fuel element flow blockage in ETR, 16: 21719 (IDO-16780)
LITTLEWOOD, R., Thermodynamics of metal–fused chloride systems, 16: 20426
LIU, Chen-ye, Optimum rectangular cooling fins, 16: 20612
LLOYD, R. D., Effects of elevated temperatures on alloys, 16: 21025 (ASD-TR-61-499)
LLUCH, M., Inhibition of selective absorption of sugars, 16: 20115
LOBBECKE, E. A., Somatic mutations in *Ephestia kühniella Z.*, 16: 20281
LOCKNEY, Eric Victor, Improvements to nuclear reactor, 16: 21785
LOEB, Horst, Ion sources, 16: 20650 (NP-tr-894)
LOMBAERT, Robert, Radiochromatographic analysis of amino acids, 16: 20347
LOMNEV, S. P., Calculating motion of charged particles on digital computer, 16: 21157
LONON, E. L., Boundary condition model of nuclear forces, 16: 21478
LONON, E. L., Many-body problem in boundary condition model, 16: 21541
LONG, Everett, Heat source and associated apparatus, 16: 21746
LONG, Everett, Improvements in valved ducting, 16: 20621
LONG, Everett, Improvements in nuclear reactors, 16: 21747
LONG, Everett, Nuclear reactor refueling machines, 16: 21754
LONG, Everett, Refueling machines for reactors, 16: 21748
LONG, Everett, Refueling machines for reactors, 16: 21749
LONG, Everett, Refueling machines for reactors, 16: 21752
LONG, R. Gordon, Synthesis of Co-57 tetraphenylporphinesulfonate, 16: 20072
LONGONI, A. M., Holomorphy domain of S matrix, 16: 21295
LOOS, Robert A., Method for handling radioactive source, 16: 20586
LORENTS, D. C., Geophysical experiments pertinent to nuclear blackout—final rpt., 16: 20814 (NP-11603)
LOSKIEWICZ, J., Ionization pulses of cosmic radiation, 16: 21249
LOTKIN, Mark, Heat flow in melting solids, 16: 20610
LOTTES, P. A., Boiling from a liquid-liquid interface, 16: 20617
LOUGHEED, R., Assay of C-14 in compounds or mixtures, 16: 20335
LOUIS, J. F., Magnetohydrodynamic generator, 16: 21847 (AFOSR-2352)
LOUNASMAA, O. V., Specific heat of Dy, 16: 21190
LOUNASMAA, O. V., Specific heat of Sm, 16: 21189
LOVE, T. A., Fast-neutron spectrometer, 16: 20745
LOVELESS, F. C., Transformers with radiation detectors, 16: 20789
LOWKE, J. J., Diffusion in drift velocity measurements, 16: 21154
LOZERON, H., Experimental eczema. XVI., 16: 20163
LU, Pao, Charged liquid drop with high angular momentum, 16: 21508
LUDWIEG, Friedrich, Strontium-90, Cs-137, and Pu-239 in hay, 16: 20128
LUKASIK, S. J., Capture of particles into stable betatron orbits, 16: 21651 (SIT-P53)
LUKYANOV, Yu. M., Velocity and concentration of particles in plasma flow, 16: 21671
LUNDGREN, T. S., Slip flow in parallel plate channel, 16: 20620
LUNDY, R. A., Muon capture rates for Ca-44 and Ca-40, 16: 21399
LUNDY, R. A., Muon capture by F-19, 16: 21400
LUNGU, Stelian, Metal-to-metal and ceramics-to-metal seals, 16: 20566 (IFA/TV/14)
LURIE, Max B., Biphasic response in resistance to tuberculosis in rabbits, 16: 20068
LUSH, G. J., Fast neutrons from p-d collisions, 16: 21475
LUTTRELL, Charles N., Pathogenesis of meningitis. I., 16: 20094
LUTZ, H. F., Reduced widths in (d,p) stripping experiments, 16: 21356 (NYO-2666)
LUTZ, Otto, Operation of a Na circulation system, 16: 20576
LYKOS, P. G., Atomic orbitals in molecular orbitals. I., 16: 20411
LYNCH, M. A., Thermoelectric direct-conversion nuclear reactors, 16: 21791 (AD-267442)
LYON, W. L., Direct hydrofluorination of Pu(III) oxalate, 16: 20354 (HW-19771)
LYONS, B. J., Gel formation in PVC on irradiation, 16: 20504
LYTLE, Farrel W., X-ray absorption fine structure, 16: 21126 (D1-82-0164)

M

MAC DONALD, J. E., Shield computer program 18-0, 16: 21691 (DC-60-7-9)
MAC DOUGALL, H. R., Cratering experiments in desert alluvium, 16: 20049 (SC-4596(RR))
MACEFIELD, B. E. F., Neutrons from reactions between H-3 and He-3, 16: 21573
MACFARLANE, M. H., Reactions (d,t) on isotopes of Ni, 16: 21557
MACHADO, W. M., Deuterons in nuclear matter, 16: 21403
MACHERAUCH, Eckard, Plastic deformation of sintered Ni, 16: 21081
MACHIN, D. J., Properties of halides of Ti and Zr, 16: 20423
MACKE, W., Nuclear models and tensor of inertia, 16: 21503
MACKEY, J. L., Reaction of rare-earth ions with EDTA, 16: 20402
MAC KINNEY, A. L., Enriched UO_2 cores studied for NMSR, 16: 21257 (BAW-1216)
MACRAE, William, Improvements in nuclear reactors, 16: 21775
MADANSKY, L., Detection and production of polarized particles, 16: 21262 (CERN-62-8)
MADDOCK, A. G., Solvent extraction from halide solutions. II., 16: 20451
MADER, Charles L., Detonation of mixed explosive substances, 16: 20375 (AEC-tr-5100)
MAFFEI, H. P., Zirconium oxide corrosion product, 16: 20979 (HW-71958-RD)
MAGAT, M., Grafting and polymerization under radiation, 16: 20483
MAGGIORA, A., Experimental eczema. XVI., 16: 20163
MAGGIORA, A., Serotonin and the local effect of x rays. II., 16: 20162
MAGNUSON, Harold J., Hazards to health in U mining and milling, 16: 20893
MAHFOUZ, Mahmood M., Hematopoietic function in radiation-induced leukopenia, 16: 20269
MAIOROVA, E. P., Extraction of Pu(IV) with TBP, 16: 20369 (AEC-tr-4457(p.161-6))
MAJIMA, Akio, Radiation malformations in the mouse fetus, 16: 20187
MAJOR, J. V., Interactions of π^- mesons with complex nuclei. III., 16: 21406
MAKIN, M. J., Formation of dislocation loops in Cu, 16: 21102
MAKINODAN, T., Radiosensitivity of spleen cells, 16: 20274
MALEEV, P. I., Nuclear radiation detectors, 16: 20689
MALINSKII, Yu. M., Effect of radiation on polyethylene insulation, 16: 20518
MALLETT, Rex William, Means for shutting down reactors, 16: 21755
MALLMANN, C. A., Asymmetric rotor theories of even-even nuclei, 16: 21460
MALONE, M., Prog. rpt. on effects of radiation on pressure vessel steels, 16: 21090 (EURAEC-140)
MAMURO, Tetsuo, Measurement of Cs-137 concentration, 16: 20123
MAMURO, Tetsuo, Observation of fall-out, 16: 20121
MAMURO, Tetsuo, Radioactive air-borne dusts, 16: 20122
MAMURO, Tetsuo, Radiochemical waste evaporator system, 16: 21861
MAMURO, Tetsuo, Treatment of radioactive waste, 16: 21862
MANDL, V., Reaction $Be^9(\alpha,n)He^6$, 16: 21401
MANDUCHI, C., Counter with reduced wall effect, 16: 20739
MANFREDINI, A., Proton-nucleon collisions, 16: 21286
MANG, H. J., Alpha decay hindrance factors, 16: 21533
MANG, H. J., Binding energies of light hyperfragments, 16: 21476
MANJARREZ, Hector, Effects of radiations in man, 16: 20261
MANN, A. K., Image-intensifier system, 16: 20719
MANN, Lloyd G., Isospin conservation and β-γ circular polarization, 16: 21616
MANNELLI, I., Recoil proton in $\gamma + p \rightarrow p + \pi^0$, 16: 21311
MANNING, J. J., Fast-neutron spectrometer, 16: 20745
MANNING, P. G., Solvent extraction studies of Eu complexes, 16: 20452

MANOWITZ, Bernard, Treatment and disposal of wastes, 16: 20314
MANQUENOUILLE, R., Nuclear lifetimes with time-to-height converter, 16: 21440
MANQUENOUILLE, Robert, Plane polarization of AcC'' γ rays, 16: 21369
MAPLETON, Robert A., Electron capture from H by protons, 16: 21200
MAPLETON, Robert A., Wave function operator in scattering theory. II., 16: 21279
MAQSOOD, M., Postirradiation protection and recovery. VI., 16: 20285
MARAKAMI, Ujihiro, Radiation malformations in the mouse fetus, 16: 20187
MARANZANA, C., Discriminating scintillation shapes, 16: 20785
MARCATO, M., Protective action of cardiac irradiation, 16: 20218
MARCAZZAN, G. M., Cross section of $Si^{28}(n,\alpha)Mg^{25}$, 16: 21413
MARCH, H. H., Lifetimes of positrons, 16: 21201
MARCH, H. H., Perturbations in an electron gas, 16: 21217
MARCH, R. H., Production of Y_1^* and K^* in π-p collisions, 16: 21289
MARCO, Caprotti, Radiation effects on vegetable mitosis, 16: 20212
MARCOVICH, H., Radiation sensitivity of T2 bacteriophages, 16: 20292
MARCU, M., Energy spectrum of γ rays. I., 16: 21389
MARCUS, Stuart M., Gamma-induced photoconductivity in capacitor, 16: 21088 (DOFL-TR-1037)
MARCUS, Y., Stability of mixed complexes, 16: 20355 (IA-731)
MARGOLIN, Harold, Study of Ti–Cs–Zr system, 16: 21074
MARGRAVE, John L., Thermodynamic properties of ions, 16: 20351 (ARL-191)
MARIN, Joseph, Strength of thick-walled pressure vessels, 16: 21735
MARINOV, A., Nuclear moments of states of Dy-161, 16: 21526
MARINOV, M., Cadmium-sulfide crystal counters, 16: 20742
MARIS, Th. A. J., Shell structure study by electron scattering, 16: 21471
MARKOV, A., Pulse scaler using multi-stable system, 16: 20794
MARKOWITZ, J. M., Diffusion of H in Zy-2, 16: 21075
MARKS, R., Stress history measurements at Gnome, 16: 20808 (PNE-105P)
MARMIER, P., Identification of B on Si, 16: 20346
MARRONE, M. J., Proton polarization in deuteron stripping at 15 Mev, 16: 21597
MARSH, B. B., Double pick-up of inequivalent nucleons in $C^{14}(d,\alpha)B^{11}$, 16: 21577
MARSHALL, W., Electric quadrupole moment of Fe-57, 16: 21418
MARSILI, F., Crystal spectrometer, 16: 20678
MARTIN, A. V. J., Electron mobility in electric fields, 16: 21282
MARTIN, Jerry B., Collision cross sections for O, C, Cl, and F, 16: 21202
MARTIN, P. W., Radiation effects on chlorination of rutile, carbon, and catalysts, 16: 20468 (BM-RI-5994)
MARTY, C., Excitation of 15.1 Mev level of C-12, 16: 21481
MASAHARU, Oshima, Strontium-89, Cs-134, and I-131 deposit into egg, 16: 20109
MASON, E. A., Transport properties of polar-gas mixtures, 16: 20414
MASON, P., Electron pairs from π^- mesons, 16: 21315
MASSALSKI, J., Ionization pulses of cosmic radiation, 16: 21249
MASSART, A., Case of late radionecrosis, 16: 20184
MASTEL, B., Microstructure of U, 16: 20953 (HW-73476)
MASUDA, H. Yoshiko, Radioactivation of In-115, 16: 21366
MASUDA, Y., Distribution and leakage of γ-rays, 16: 20881
MASUDA, Yoshiko, Relaxation in superconducting Al alloys, 16: 21184
MATALINA, L. A., Processing data from multi-channel analyzers, 16: 20771
MATE, F., Radioactive fertilizers. I. phosphates, 16: 20475 (CEA-tr-X-434)
MATHIAS, A., Studies of organo-alkali metal complexes. V., 16: 20453
MATHIAS, A., Studies of organo-alkali and alkaline earth metal complexes. VI., 16: 20454
MATHIEU, J., Performance of ionization chambers, 16: 20734
MATHIS, A., Design for reactor safety systems, 16: 21724 (NP-11701)
MATSUMURA, Takashi, Radiochemical waste evaporator system, 16: 21861
MATSUMURA, Takashi, Treatment of radioactive waste, 16: 21862
MATSUNAMI, Todao, Observation of fall-out, 16: 20121
MATSUNAMI, Todao, Radioactive air-borne dusts, 16: 20122
MATTING, Alexander, Electric arc metal sputtering processes, 16: 20968
MATVEEV, V. V., Gaseous scintillation counter, 16: 20710
MATZNER, Bruce, Prog. rpt. on heat transfer, 16: 20593 (TID-15637)
MAUNG, Maung Tin, Total cross section of K^- mesons on nucleons, 16: 21360 (UCRL-10125)
MAURER, H. J., Half life of I-131 in thyroid, 1o: 20085
MAURICE, Francoise, Diffusion and solubility of Fe in Be, 16: 21054
MAUTNER, Henry G., Labeling the P of nucleotides, 16: 20494
MAXIMON, L. C., Polarization of γ rays from neutral particle decays, 16: 21265 (NP-11600)
MAY, Raoul Michel, Irradiation and ovarian grafts, 16: 20139
MAY, Serge, Determination of Co, As, and Mn in steel, 16: 20330
MAYER, B. E., Ammineruthenium(III) phosphates, 16: 20422
MAZZOLENI, G. F., Glomerular microcirculation, 16: 20214
MAZZOLENI, G. F., Radiation effects on salivary glands, 16: 20216
MAZZOLENI, G. F., Radiation effects on salivary glands, 16: 20217
MC AFEE, John G., Synthesis of Co-57 tetraphenylporphinesulfonate, 16: 20072
MC BRIDE, J. P., Radiation stability of aqueous thoria, 16: 21095 (ORNL-3274)
MC CALLUM, K. J., Radiation decomposition of Na chlorate, 16: 20506
MC CARROLL, R., Charge transfer, 16: 21273
MC CARROLL, R., Physics of upper atmosphere, 16: 21121 (AFCRL-1062)
MC CARTHY, Ian E., Information from reactions at extreme angles, 16: 21550
MC CLELLAN, R. O., Dosimetry of Cs-137 in sheep, 16: 20105
MC CLUEN, W. D., Gravimetric factors for U, 16: 20319 (K-1476(Rev.I))
MC COLLUM, John D., Triplet excitation induced by electron irradiation, 16: 20467 (ASD-TDR-62-32(Pt.II))
MC COY, F. J., Electrostatic generators for spacecraft, 16: 21855
MC DANIELS, John D., Jr., Storage arrangement, 16: 21788
MC DONALD, F. B., Heavy nuclei in primary cosmic radiation, 16: 21241
MC DONALD, W. A., Prog. rpt. on SNAP 7 program, 16: 21127 (MND-P-2483-5)
MC FADDEN, P. W., Nucleate pool boiling, 16: 20601
MC FARLANE, E. F., Nitridation of Li, 16: 20456
MC GEACHIN, Robert L., Inhibition of mammalian amylases, 16: 20061
MC GONNAGLE, Warren J., Nuclear quality standards, 16: 21742
MC INTYRE, J. A., Energy level selection in neutron transfers to Pb isotopes, 16: 21536
MC KENNA, James, Relativistic quantum field theory, 16: 20938
MC KENNEY, J. R., Dosimetry of Cs-137 in sheep, 16: 20105
MC KEOWN, M., Properties of collective states in Os-186, 16: 21461
MC LEAN, E. A., Optical refractivity of free electrons, 16: 21673
MC MANUS, H., Interaction of fast nucleons with nuclei, 16: 21464
MC MURRAY, C. S., Program for determining first-collision neutron doses, 16: 20877 (Y-1386)
MC NABB, Mark D., Prog. rpt. on Ta extrusion, 16: 20992 (ASD-TR-7-783 (III))
MC QUILLAN, A. D., Titanium–Zr–H system, 16: 21072
MC TIGUE, Gerald E., Multicomponent cascade theory, 16: 20924 (TID-15054)
MC VOY, K. W., Electron-nucleus scattering, 16: 21474
MC WHIRTER, R. W. P., Recombination between electrons and ions. I., 16: 21683
MEEGUNGWAN, C., Treatment of meats with radiations. IX., 16: 20915
MEGY, Jean, Burst jacket detection in nuclear reactors, 16: 21783
MEGY, Jean, Coordinates of suspected elements in a network, 16: 20577
MEIXNER, Billy D., Interaction of shock or rarefaction with a bubble, 16: 20608
MEIXNER, J., Interaction of EM fields with plasmas, 16: 21661 (AFCRL-746)
MELA, R. L., Prog. rpt. on flow balancing device in BWR, 16: 21820 (TID-15436)
MELENEVSKII, V. N., Electrosynthesis of ozone, 16: 20463
MELKANOFF, M. A., Shape of imaginary part of optical model potential, 16: 21540
MELTON, Charles Estel, Ionization produced by α particles in Ar mixtures, 16: 21136 (TID-15708)
MENNRATH, P., Transitions in O-16, 16: 21411
MERCHIE, G., Circulation time of peripheral blood, 16: 20053
MEREDITH, O. M., Radiation-induced hyperpyrexia in rabbits, 16: 20279
MERMIN, N. David, Gas–liquid transition. I., 16: 21148
MERMIN, N. David, Gas–liquid transition. II., 16: 21149
MERRISON, A. W., Pion and muon physics. I., 16: 21272
MERTEN, D., Contamination of placenta with Sr-90, 16: 20107

MESHKOV, N., Many-body perturbation in soluble model, 16: 21512
MESHKOV, S., Sakata model of unitary symmetry, 16: 21317
MESHKOV, S., Shell model and relation to rotation and vibrations, 16: 21622
MESMER, Robert E., Exchange of D with solid K hydroborate, 16: 20401
MESSIER, J., Properties of silicon n-i-p junctions, 16: 20748
METCALF, W. K., Effects of irradiation in rats, 16: 20196
METHERINGHAM, A. J., Fast neutrons from p-d collisions, 16: 21475
METZGER, F. R., Lifetime measurements using resonance fluorescence, 16: 21442
MEYER, M. A., Scattering of cosmic ray muons, 16: 21248
MEYER-ARENDT, Jurgen R., Application of autoradiography, 16: 20054
MICHEL, M. C., Alpha decay scheme of Am-242m, 16: 21518
MICHELETTI, S., Proton polarization in deuteron stripping at 15 Mev, 16: 21597
MICHIE, Donald, Maternal-fetal barrier in the mouse. I., 16: 20066
MICHIE, Donald, Maternal-fetal barrier in the mouse. II., 16: 20067
MICKLEM, H. S., Rejection of skin grafts by normal and x-irradiated mice, 16: 20267
MIDDLETON, R., Energy levels of O-18, O-20, F-21, and Na-25, 16: 21627
MIDDLETON, R., Evidence for $(2I + 1)$ rule, 16: 21515
MIDDLETON, R., Reaction $Mg^{24}(d,p)Mg^{25}$, 16: 21592
MIDDLETON, R., Reaction $B^{10}(d,p)B^{11}$ at 10.1 Mev, 16: 21593
MIGDAL, A., Quadrupolar and dipolar γ radiation of nuclei, 16: 21363 (UCRL-Trans-822(L))
MIGUEL, M., Calibration of nuclides, 16: 20667
MIHAIL, A., Prog. rpt. on two-phase flows, air–water, 16: 20597 (EURAEC-144)
MIKHAILENKO, I. E., Radiation effects on catalytic activity of Al oxide, 16: 20482
MIKHEEVA, V. I., Solid solutions of Na and K hydrides, 16: 20388
MIKKE, K., Angular distribution of fission fragments, 16: 20736
MILAZZO, M., Cross section of $Si^{28}(n,\alpha)Mg^{25}$, 16: 21413
MILLER, C. Joyce, Rats infected with *Trichinella spiralis* larvae, 16: 20137
MILLER, D. W., Coulomb-distorted (d,p) angular distributions, 16: 21580
MILLER, D. W., Polarization measurement of (d,p) reactions, 16: 21581
MILLER, G. L., Physics of semiconductor radiation detectors, 16: 20629 (BNL-699)
MILLER, G. R., Cratering experiments in desert alluvium, 16: 20049 (SC-4596(RR))
MILLER, P. D., Corrosion investigation of alloys, 16: 20974 (BMI-X-198)
MILLER, W. R., Radioisotope product dating, 16: 20909 (TID-15034)
MILLIN, Gisela, Effects of radiation on white mice. I., 16: 20288
MINAFRA, A., Elastic scattering of $\pi^+ + p$, 16: 21293
MINC, I., Preparation of Th–Zn alloys, 16: 20966
MINCZEWSKI, Jerzy, Separation of rare earths. III., 16: 20549
MINGUZZI, A., Axiomatic dispersion relations, 16: 21307
MINKOFF, I., Growth of graphite from melts, 16: 21066
MINSKI, Margaret, Radiation doses from administered radionuclides, 16: 20152
MINTER, F. H., Formation of dislocation loops in Cu, 16: 21102
MINTS, R. S., Study of Fe–Al alloys, 16: 21056
MITCHELL, D. R., Prog. rpt. on Ti sheet rolling program, 16: 21009 (AD-264815)
MITROFANOVA, L. V., Effect of radiation on polyethylene insulation, 16: 20518
MITTENBACHER, J., 1-Mv cascade generator, 16: 21655
MIWA, H., Radiation-pulse transmission, 16: 20800
MJASSOEDOV, Boris, Extraction and determination of Pa, 16: 20329
MOCK, J. B., Resonance of S-state ions in metals, 16: 21192
MOELLER, Manfred, Determination of pole figures with texture goniometer, 16: 21017 (AE-68)
MOFFETT, D. Reed, Space environment and its interactions with propellants, 16: 21845 (AD-266034)
MOHAN, G., Analyticity of the spectral function, 16: 21294
MOISEEV, A. M., Inelastic nuclear scattering of photons, 16: 21641
MOISEIWITSCH, B. L., Physics of upper atmosphere, 16: 21121 (AFCRL-1062-I)
MOISSIS, R., Prog. rpt. on flow balancing device in BWR, 16: 21820 (TID-15436)
MOLDAUER, P. A., Relation between optical model and resonance theory, 16: 21624
MOLLEANUER, James F., Gamma yields from compound nucleus reactions, 16: 21457
MONAHAN, J. E., Measurement of energy and intensity of γ rays, 16: 20628 (ANL-6499)
MONARO, S., Levels in Sm-150 from Eu-150 decay, 16: 21396
MONCHICK, L., Transport properties of polar-gas mixtures, 16: 20414
MONCRIEF, E. C., Corrosion of volatility pilot plant hydrofluorinator, 16: 20538 (ORNL-TM-186)
MONGELLI, S., Elastic scattering of $\pi^+ + p$, 16: 21293
MONK, C. B., Solvent extraction studies of Eu complexes, 16: 20452
MONKS, A. L., Behavior of fission gases in UO_2, 16: 21043 (AEC-tr-5103)
MONKS, A. L., Glide elements of Be deformation, 16: 21045 (AEC-tr-5138)
MONTAGUE, J. H., Semiconductor counters, 16: 20752
MONTAGUE, J. H. Monge, 2.2-Mev level in Al-27, 16: 21519
MONTERO-CASTILLO, J., Anomaly genesis in interkinetic nuclei, 16: 20215
MOORE, A., Tensile deformation of Be, 16: 21062
MOORE, Charlotte E., Ultraviolet multiplet table, 16: 20357 (NBS-C-488 (Sect.3))
MOORE, Charlotte E., Ultraviolet multiplet table, 16: 20358 (NBS-C-488(Sect.4))
MOORE, Richard Valentine, Improvements in reactors, 16: 21745
MOORHOUSE, R. G., Relations in $\bar{K}$-nucleon absorption. II., 16: 21299
MORA, S., Proton-nucleon collisions, 16: 21286
MORACHEVSKAYA, M. D., Reaction of uranyl salts with NaOH, 16: 20368 (AEC-tr-4457(p.98-107))
MORALES, A., Pure states of n-identical particles, 16: 21280
MORALES S., Guillermo, Reconnaissance for U in Peru, 16: 20818 (RME-4517)
MORAND, M., Proton-nucleon collisions, 16: 21286
MORDVINOVA, N. P., Pathogenesis of radiation injuries of skin, 16: 20132 (JPRS-13644)
MORDVINOVA, N. P., Treatment of radiation injuries, 16: 20278
MOREY, F., Definition of nuclear potentials, 16: 21402
MORGAN, James M., Jr., Stream survey of U mining and milling area, 16: 20815 (NYO-7831)
MORI, Satoshi, Malignant neoplasm mortality among survivors, 16: 20250
MORITA, Kazuo, Attenuation curve in lead of γ rays, 16: 21697
MORITZ, A. G., Stretching frequencies of deuterated amines, 16: 20446
MOROSON, H., Cross-linking of DNA to protein, 16: 20198
MORRISON, G. C., Angular distributions of $Be^9(d,n)B^{10}$ neutrons, 16: 21588
MORTENSEN, E. M., Equilibrium properties of H_2, 16: 21177
MORTENSON, J. H., Enriched UO_2 cores studied for NMSR, 16: 21257 (BAW-1216)
MORTON, G. A., Developments in fast photomultipliers, 16: 21436
MOSHINSKY, M., Solutions for pairing quadrupole-quadrupole interactions, 16: 21507
MOSS, Robert W., Phase transformation in single-crystal $SrTiO_3$, 16: 21032 (D1-82-0163)
MOSZKOWSKI, Steven A., Systematics of β-decay matrix elements, 16: 21608
MOTAWAKEL, Abdul Ghafar, Resorption time of cutaneous wheals, 16: 20145
MOTT, W. E., Quartz for neutron activation studies, 16: 20336
MOUGIN, B., Experiments with a spark chamber, 16: 20729
MOURADIAN, E., Reactor safety, 16: 20300 (ANL-6477(p.168-203))
M'PHERSON, P. K., Reactor control studies, 16: 21713 (AEEW-R-121)
MRAVCA, Andrew E., Nuclear Superheat Meeting No. 5, 16: 21817 (TID-7630)
MUCHIN, I. E., Examination of water for radioactivity, 16: 20889
MUDGE, R. B., Nitrides of metals, 16: 20379 (UCRL-Trans-817)
MUELLER, A., Protective effects of cysteine and cysteamine, 16: 20293
MUELLER, Donald D., Surface ionization and ion propulsion, 16: 21846 (AD-268695)
MUELLER, I., Somatic mutations in *Ephestia kuhniella Z.*, 16: 20281
MUELLER, R., Photoneutrons from Be-9, 16: 21410
MUELLER, Walter A., Saturation of mammalian bones with Sr, 16: 20108
MUELLER, William F., Orientation of resonance samples, 16: 20701
MUIR, C. W. A., Production of uranous double fluorides, 16: 20530

MUIRHEAD, H., Nuclear capture of polarized muons, 16: 21426
MULLENDORE, Arthur W., Grain boundary sliding in Al and its alloys, 16: 21024 (ASD-TR-61-383)
MUNIR, R., Sakata model of unitary symmetry, 16: 21317
MUNRO, Robert, Fluid flow control valve, 16: 20623
MUNTIU, N., Influence of radiation on treatment of trypanosomiasis, 16: 20256
MURPHEY, B. F., Cratering experiments in desert alluvium, 16: 20049 (SC-4596(RR))
MURPHY, P. G., Polarization in π^--p scattering, 16: 21323
MURPHY, T., Wood density measurements in criticality clearance of transport containers, 16: 20861 (AHSB(S)R-36)
MURRAY, A. M., Lifetimes of positrons, 16: 21201
MURRAY, A. M., Perturbations in an electron gas, 16: 21217
MURRAY, R. B., Fast-neutron spectrometer, 16: 20745
MURRENHOFF, A. P., Production of Te-132, I-132, Mo-99, and Tc-99m, 16: 20544
MURTHA, B. E., Prog. rpt. on UO_2 fuel systems, 16: 20951 (CEND-149)
MURTHY, S. R. S., Angular distribution of fission fragments, 16: 20736
MURTHY, V. Rama, Silver in Fe meteorites, 16: 20829
MUTA, Nobuyoshi, Attenuation curve in lead of γ rays, 16: 21697
MUTSCHKE, U., Contamination of placenta with Sr-90, 16: 20107
MUXART, Roland, Extraction and determination of Pa, 16: 20329
MYASISCHCHEVA, G. G., Radiolysis of aqueous solutions, 16: 20520

N

NAGARAJAN, M. A., Deuteron widths in 1p-shell nuclei, 16: 21354 (NP-11682)
NAGARAJAN, M. A., Shell model analysis of $B^{11}(d,n)C^{12}$, 16: 21353 (NP-11681)
NAGATANI, K., Reactions $Li^6(Li^6,d)B^{10}$ and $Li^7(Li^6,t)B^{10}$, 16: 21598
NAIRN, John Syme, Production of metals (Th and Pu), 16: 20533
NAKAMURA, T., Multistage light intensification, 16: 20726
NAKASHIO, Seizo, Polymerization of oxetanes by radiation, 16: 20503
NAMBA, Shingo, Formation of $UC_{1-x}O_x$, 16: 21050 (NP-tr-901)
NANEVICZ, J. E., Geophysical experiments pertinent to nuclear blackout—final rpt., 16: 20814 (NP-11603)
NANK, W. K., Radiation sterilization of food. II., 16: 20914
NARDELLI, G. F., Dynamics of cubic crystals, 16: 21186
NARDON, Paul, Effects of γ rays on *Sitophilus sasakii*, 16: 20159
NASH, W. F., Analysis of flash tube data, 16: 20679
NASH, W. F., Design of flash tube arrays, 16: 20680
NATELSON, Samuel, X-ray spectroscopy in the clinical laboratory. VI., 16: 20331
NATH, Narendra, Neutron scattering cross sections in Pb isotopes, 16: 21545
NATHAN, O., Collective character of 2.33-Mev state in Sn-116, 16: 21499
NAUMANN, D., Reprocessing of U fuels, 16: 20552
NAZAPENKO, N. G., Coffinite and nature of nasturan pseudocrystals, 16: 20834
NAZARENKO, N. G., Thermal studies of U and U-bearing minerals, 16: 20853
NAZAROV, P. P., Sorption of radioelements by soils. I., 16: 20460
NAZAROV, P. P., Sorption of radioelements by soils. II., 16: 20461
NAZAROV, P. P., Sorption of radioelements by soils. III., 16: 20462
NELSON, I. C., Radiological conditions in vicinity of Hanford, 16: 20868 (HW-71999)
NELSON, J. W., One-minute positron decay from $K^{38}(\alpha,n)Sc^{41}$, 16: 21636
NELSON, Robert A., Prog. rpt. on UO_2 powders, 16: 20961 (UNC-1001)
NERI, F., Protective action of cardiac irradiation, 16: 20218
NESMEYANOV, A. N., Hot synthesis of compounds labeled with H-3 and C-14, 16: 20473 (AEC-tr-5082)
NESTOR, C. W., Jr., EQUIPOISE 3A, 16: 20930 (ORNL-3199(Add.))
NESTORESCO, N., Radiation in infection with pathogenic *staphylococci*, 16: 20257
NEUBERT, Theodore J., Thermal bleaching of Cl_2^- centers, 16: 20415
NEUGEBAUER, F. J., Force and torque variations of double-acting "steamotor", 16: 20556 (AD-269392)
NEUGEBAUER, F. J., Liquid shear transmission, 16: 20557 (AD-269396)
NEUMANN, W., Electron beam welding, 16: 21000
NEWMAN, E., Single-nucleon reactions induced by 28-Mev N-14 ions, 16: 21575
NEWNHAM, I. E., Properties of halides of Ti and Zr, 16: 20423
NEWPORT, R. W., Electron pairs from π^- mesons, 16: 21315
NEWSHAM, L. G. S., Regional pulmonary function studies with Xe-133, 16: 20065
NEWSON, Henry W., Collective motion in excited nuclei, 16: 21513
NEWTON, Alison, Use of tritiated thymidine, 16: 20104
NEWTON, D., Gamma rays from proton scattering from C, 16: 21468
NEWTON, D., Reactions (n,np), (p,pn), and (p,2p) on C-12, 16: 21466
NEWTON, D., Scattering of 150-Mev protons from Ca-40, 16: 21500
NEWTON, R. C., Fusion curve of Cs, 16: 21191
NEY, E. P., Solar protons, α particles, and heavy nuclei, 16: 21239
NICKOLA, W. E., Pressure vessel strain concentrations, 16: 21027 (DC-59-12-216)
NICKOLA, Wayne E., Photostress techniques, 16: 21026 (DC-59-6-224 and Add.)
NIELSEN, H. L., Decay of 2.1-hour Ta-178, 16: 21422
NIELSEN, O. B., Coupling of K = 2 band to ground state rotational band, 16: 21521
NIEWODNICZANSKI, H., Scattering of 13-Mev deuterons on light nuclei, 16: 21566
NIEWODNICZANSKI, Jerzy, Natural radioactivity of Cu ores, 16: 20847
NIKOLAEV, F. A., Inelastic nuclear scattering of photons, 16: 21641
NIKOL'SKII, B. P., Reaction of uranyl salts with NaOH, 16: 20368 (AEC-tr-4457(p.98-107))
NILSSON, A., Angular distributions from reaction $Li^7(\alpha,n)B^{10}$, 16: 21602
NILSSON, S. G., Giant E1 resonance for deformed nuclei, 16: 21524
NIR, A., Determination of aquifer parameters, 16: 20840
NISHIDA, Y., Theory of transfer reactions, 16: 21555
NOBLES, Ralph A., Long-range particles from nuclear fission, 16: 21420
NODVIK, J. S., Shape of imaginary part of optical model potential, 16: 21540
NOLEN, Robert K., Brazing of Mo sheet, 16: 20988 (ARF-2232-2)
NOMICOS, G., Traveling-wave technique of cyclotron radiation, 16: 21281
NORTHCLIFFE, L. C., Reactions $Li^6(Li^6,d)B^{10}$ and $Li^7(Li^6,t)B^{10}$, 16: 21598
NORTHROP, D. C., Solid-state ionization chamber, 16: 20749
NORWOOD, James Malone, Jr., Concentration of Zr nitrate solutions, 16: 20465
NOTZ, K. J., Hydrogen reduction of U oxides, 16: 20528
NOVEK, J., Autoradiographic apposition method, 16: 20338
NOVICK, R., Prog. rpt. on electromagnetic spectrum, 16: 21129 (NP-11640)
NOVIKOV, A. N., Colloid Au in treatment of lung cancer, 16: 20099
NOVIKOVA, I. A., Phase diagram of alloys of Mg–Nd, 16: 20372 (AEC-tr-4457(p.197-204))
NOVIKOVA, I. S., Oxygenated complexes on the surface of graphite, 16: 20387
NOVY, Virgil F., Passivation of reactive metal surfaces, 16: 20970
NOWIKOWSKI, L. J., Prog. rpt. on machining refractory materials, 16: 20999 (ASD-TR-7-532a(VI))
NOYES, H. Pierre, Nuclear forces, 16: 21463
NOYES, H. Pierre, Three-pion resonance and implications, 16: 21620
NOZAKI, Hiroshi, Strontium-89, Cs-134, and I-131 deposit into egg, 16: 20109
NOZAWA, Masao, Study of Cd isotopes. II., 16: 21381
NUKADA, Koukichi, Spectra of dimethoxy methane, 16: 20447
NUNEZ-LAGOS, R., Pure states of n-identical particles, 16: 21280
NURMIA, M., Low-level α spectrometry, 16: 20735
NURZYNSKI, J., Scattering of 13-Mev deuterons on light nuclei, 16: 21566
NYHOLM, R. S., Properties of halides of Ti and Zr, 16: 20423
NYSTEN, K-E., Gamma-γ directional correlations in Pb-208, 16: 21635

O

OAE, Shigeru, Design of tracer laboratory, 16: 20568
OAE, Shigeru, Hydrogen–deuterium exchange reactions, 16: 20306
OAE, Shigeru, Radiation reaction of Si hydride, 16: 20478
OAE, Shigeru, Radiation oxidation of Sn chloride, 16: 20479
OBERHOLTZER, J. D., One-minute positron decay from $K^{38}(\alpha,n)Sc^{41}$, 16: 21636
OBLIVIN, A. N., Turbulent air flow in axisymmetrical channels, 16: 20606

CAMPO A., Adolfo, Reconnaissance for U in Peru, 16: 20818 (RME-4517)
DESTMAN, Boerje, Acid-induced aromatic H exchange. IV., 16: 20383
DESTREICH, M. D., Scintillation properties of alkali halides, 16: 20707
DFER, S., Nuclear moments of states of Dy-161, 16: 21526
GAWA, Kiyoshi, Theta pinch device, 16: 21669
GAZA, S., Attenuation of Ta-181 133-482 kev cascade, 16: 21350 (NP-11602)
GDEN, H. R., Tensile properties of binary Ti–Zr and Ti–Hf alloys, 16: 21058
HLENDORF, Wolfgang, Penetration of glow discharge into gap, 16: 21685
IHO, Atsuyoshi, Hydrogen–deuterium exchange reactions, 16: 20306
IKABE, Shigeru, Calorimeter for intense electron beams. I., 16: 20651
IKABE, Shigeru, Nonobstructive electron beam monitor, 16: 20653
IKABE, Shigeru, Secondary electron monitor. I., 16: 20652
IKAMOTO, Shinichi, Radiation damage of shielding glass, 16: 21097
IKUI, Toshiro, Proton-neutron mass difference, 16: 21285
ILARIU, A., Distillation of isotopic mixtures in tapered conditions, 16: 20922 (IFA/DF/15)
ILDE, G. L., Surface dose measurements, 16: 20688
ILES, A., Ionization pulses of cosmic radiation, 16: 21249
ILIVER, R., Plastic phosphor well counter, 16: 20658
ILIVER, R., X-ray dose-response relationship, 16: 20153
ILLERHEAD, R., Reactions $Li^6(Li^6,d)B^{10}$ and $Li^7(Li^6,t)B^{10}$, 16: 21598
ILLIVIER, B., 20 MHz transistorized clock, 16: 20766
ILSEN, Hookon, Polarization of γ rays from neutral particle decays, 16: 21265 (NP-11600)
ILSEN, T. M., Program for multiple lethargy level cell corrections for slab cells, 16: 21721 (MND-C-2500-2)
ILSON, John C., Laboratory arc melting furnace, 16: 20989 (ASD-TN-61-32)
ILSSON, Stig, Acid-induced aromatic H exchange. II., 16: 20382
ILSSON, Stig, Acid-induced aromatic H exchange. IV., 16: 20383
ILTHAHNS, O., Somatic mutations in *Ephestia kuhniella Z.*, 16: 20281
INDIS, H. B., Program for calculation of capture probabilities, 16: 20933 (WAPD-TM-273)
IPHEL, I. L., Absorption of Sr-90 by fish, 16: 20106
IPPENHEIM, Bina, Effect of uv irradiation on bacteria, 16: 20149
IRBACH, R., Spin-lattice relaxation time of Sn ethyl sulfate, 16: 21188
IRD, Margery G., Rat liver after x radiation *in vivo*, 16: 20199
ISADA, J., Deuterons in nuclear matter, 16: 21403
ISADA, J., Treatments of fermion pairs, 16: 21292
ISAJIMA, Shiro, Blood picture of Nagasaki survivors, 16: 20248
ISAJIMA, Shiro, Hematological studies on survivors in Nagasaki, 16: 20249
ISTANEVICH, Yu. (Iu.) M., Energy spectrum of resonance absorption of γ rays in Zn-67, 16: 21362 (AEC-tr-5115)
ISTER, Gisela Kellmann, Energy transfer in radiation chemistry, 16: 20510
ISTERRIETH, P. M., Radiosensitivity of *Escherichia freundii*, 16: 20144
'SULLIVAN, R. A., Wood density measurements in criticality clearance of transport containers, 16: 20861 (AHSB(S)R-36)
ITT, K., Neutron transport problem in fuel elements, 16: 21344
ITTERMAN, Bernard, Bubble dimensions and boiling action, 16: 20618
IUYANG, Bingyork, Investigation on manufacture of portable Geiger counter, 16: 20666
IWAKI, K., Multistage light intensification, 16: 20726
IWENS, James J., Corrosion of C and low alloy steels, 16: 20976 (BW-3871)
IZUMO, Nobuo, Leukemia of Nagasaki atomic bomb survivors, 16: 20251

P

PACK, D. C., Magnetogasdynamic shock waves, 16: 21178
PACKMAN, Gordon, Improvements in fuel elements, 16: 21771
PACKMAN, Gordon, Nuclear reactor refueling machines, 16: 21754
PACKMAN, Gordon, Rotary motion transmission driving means, 16: 21751
PAGES, A., Problems raised by pulse analyzers, 16: 20777
PAI, S. I., Radiation magnetogasdynamics, 16: 21124 (AFOSR-2674)
PALKO, A. A., Spectra of trifluoride-dimethyl ether complex, 16: 20445
PALM, Christof, Primordial organic chemistry. I., 16: 20495
PALMER, J. G., Leukocyte kinetics, 16: 20062
PALOMINO, J. Vera, Acid leaching of U mineral, 16: 20526
PANCHENKOV, G. M., Separation of C isotopes by bicarbonate method, 16: 20925 (CEA-tr-R-1495)
PANDRES, Dove, Jr., Wave functions from quantum-mechanical principles, 16: 21163
PANDYA, I. M., Wave solutions in general relativity. I., 16: 21207
PANDYA, S. P., Collective vibrations in even-even nuclei, 16: 21494
PANDYA, S. P., Neutron-proton interactions in Li-6, 16: 21532
PANOS, T. C., Radioiodine in children, 16: 20891
PANTIC, V., Recovery effect of liver DNA injected into irradiated rats, 16: 20283
PAOLETTI, A., Crystal spectrometer, 16: 20678
PAOLINI, F. A., Liquid diffusion in skin of irradiated animals, 16: 20213
PAPAGNI, L., Radiation dose in heart x-ray investigation, 16: 20888
PAPINEAU, L., Excitation functions of $V^{51}(p,n\gamma)Cr^{51}$, 16: 21626
PARAMONOVA, V. I., Reaction of uranyl salts with NaOH, 16: 20368 (AEC-tr-4457(p.98-107))
PARHAM, A. G., Observations on extensive air showers. IX., 16: 21255
PARK, Edwin A., Flexible protective plastic shield, 16: 20587
PARKER, R. P., Fission products in drinking waters, 16: 20126
PARKHOUSE, P. G. J. T., Interactions of π^- mesons with complex nuclei. III., 16: 21406
PARKINSON, W. C., Interpretation of gross structure studies, 16: 21583
PARLIER, B., Experiments with a spark chamber, 16: 20729
PARSONS, B. J., Assay of Ca-45 by scintillation counting, 16: 20334
PARZEN, G., Perturbation theory for accelerators, 16: 21648 (MURA-634)
PARZEN, George, PARMESH dynamics program-III, 16: 20929 (MURA-635)
PARZEN, P., Traveling-wave technique of cyclotron radiation, 16: 21281
PASCAL, A., Local characteristics of photomultipliers, 16: 20728
PASHKOV, A. B., Ion exchange separation of rare-earth elements, 16: 20371 (AEC-tr-4457(p.187-9))
PASQUIER, R., Emission of deuterons and tritons and correlations in nuclei, 16: 21488
PASSELL, T. O., Geophysical experiments pertinent to nuclear blackout—final rpt., 16: 20814 (NP-11603)
PATRICK, J. W., Grain density of emulsion tracks, 16: 20677
PATRICK, P. F., Radiation decomposition of Na chlorate, 16: 20506
PATT, Harvey M., Protection and treatment of mammals, 16: 20242
PATTERSON, T. N. L., Ionic distributions in exosphere, 16: 21120 (AFCRL-62-294)
PAUL, E. B., 2.2-Mev level in Al-27, 16: 21519
PAULSEN, F. R., Chemists' contribution to nuclear energy, 16: 20309
PAVORD, Wanda M., Inhibition of mammalian amylases, 16: 20061
PAVORD, William C., Inhibition of mammalian amylases, 16: 20061
PEARLSTEIN, L. D., Cluster model calculations in light nuclei, 16: 21496
PEARLSTEIN, L. D., Generalized cluster wave functions, 16: 21398
PEARSON, A., Protective system design for reactors, 16: 21793 (AECL-1495)
PECKHAM, W. D., Excretion of radioactivity, 16: 20084
PEER, James, Blood volume in polycythemia vera and treatment with P-32, 16: 20117
PEIERLS, R. E., Velocity-dependent nuclear forces, 16: 21619
PEKERIS, C. L., States of H^- and of He, 16: 21199
PELLEGRINI, U., Crystal spectrometer, 16: 20678
PELRAS, M., Corrosion of Zy by H_2O or steam, 16: 20985
PENEV, V. N., Scattering of Λ and K_1^0 on H_2, 16: 21264 (JINR-D-820)
PENNY, S. K., Program for computing γ transmission through slabs, 16: 20931 (ORNL-TM-167(Rev.))
PERCHEREAU, J., Time-of-flight spectrometry of neutrons scattered by C, 16: 21378
PERCY, E. J., Oxidation of organic sulfides. XI., 16: 20499
PEREY, F., Scattering of neutrons by nuclei, 16: 21390
PEREZ, C. Capdevila, Determination of impurities in rare earths, 16: 20327
PERKIN, J. L., Survey of (F-19, F-18) neutron transfer reactions, 16: 21428
PERL, M. L., Luminescent chamber, 16: 20722
PERL, Martin, Image intensifier-scintillator for weak beams, 16: 20642 (NP-11663)
PERL, Martin L., Status of the scintillation chamber, 16: 20641 (NP-11616)
PERLMAN, I., Alpha decay scheme of Am-242m, 16: 21518

PERLMAN, M. L., Properties of collective states in Os-186, 16: 21461
PERLMAN, P. L., Excretion of radioactivity, 16: 20084
PERLOW, G. J., Electric quadrupole moment of Fe-57, 16: 21418
PESSALL, N., Titanium–Zr–H system, 16: 21072
PESTEIL, Louise, Electron spectra of phenanthrenes, 16: 20308
PETER, M., Resonance of S-state ions in metals, 16: 21192
PETERSDORF, Robert G., Pathogenesis of meningitis. I., 16: 20094
PETERSON, D. B., Radiolysis of aqueous systems, 16: 20514
PETERSON, G. A., Inelastic electron scattering from the deuteron, 16: 21640
PETERSON, O. P., Effects of radiation on virus immunity, 16: 20227
PETERSON, Robert L., Calculation of thermal conductivity, 16: 21198
PETERSON, V. Z., Recoil proton in $\gamma + p \rightarrow p + \pi^0$, 16: 21311
PETERSON, William J., Radiosensitivity of spleen cells, 16: 20274
PETRAVIC, M., Angular distributions from reaction $V^{51}(n,d)Ti^{50}$, 16: 21554
PETRAVIC, M., Scattering length (n-n) from D(n,p)2n, 16: 21472
PETRUKHIN, V. I., Conserved vector current hypothesis, 16: 21321
PETTERSSON, B. G., Effects of nuclear penetration on electron-γ correlations, 16: 21449
PETTIT, Frederick S., Oxidation of iron and cobalt, 16: 20360 (NYO-10289)
PFAFFELHUBER, Josef, Protection of water against radioactive pollutants, 16: 21864
PFEFFER, Richard L., Acoustic-gravity wave propagation, 16: 20838
PFEFFER, Richard L., Acoustic-gravity wave propagation, 16: 20837
PFENNIG, G., Chart of nuclides, 2nd ed., 1961, 16: 21430
PFLEGER, Karl, Uptake of V in *Ciona intestinalis*, 16: 20119
PFLUG, I. J., Removal of radioactive soil, 16: 20071
PHEIL, C. G., Removal of radioactive soil, 16: 20071
PHILLIPS, G. C., Cluster model interpretation of energy width, 16: 21543
PHILLIPS, G. R., Hemoglobin formation in chick embryo, 16: 20260
PHILLIPS, Harold O., Adsorption on inorganic materials. IV., 16: 20403
PHILLIPS, W. R., Reaction $C^{13}(C^{13},\alpha)Ne^{20}$, 16: 21603
PICKERING, John E., Problems in shielding, 16: 20241
PIDDINGTON, J. H., Cosmic magnetic fields, 16: 21234
PIERCE, E. T., Geophysical experiments pertinent to nuclear blackout—final rpt., 16: 20814 (NP-11603)
PIERCY, G. R., Detection of displacement spikes, 16: 21106
PIERCY, G. R., Radiation damage in pure Al, 16: 21101
PINKLEY, Clyde W., NMR measuring device, 16: 20703
PINKLEY, Clyde W., NMR measuring and control device, 16: 20705
PINTE, Guy, Determination of Co, As, and Mn in steel, 16: 20330
PIOVELLA, C., Glomerular microcirculation, 16: 20214
PIPER, R. D., Production of U from U oxides, 16: 20527
PIROGOVA, G. N., Radiation effects on catalytic activity of Al oxide, 16: 20482
PISAREVA, N. A., Radiation reaction in patients with cancer, 16: 20102
PISHAROTY, P. R., Sudden commencements of geomagnetic storms, 16: 21230
PITZER, Kenneth S., Bonding in fused alkali halide–metal systems, 16: 20400
PLANE, D. E., Electron pairs from π^- mesons, 16: 21315
PLENDL, H. S., One-minute positron decay from $K^{39}(\alpha,n)Sc^{42}$, 16: 21636
PLYLER, Earle K., Infrared spectrum of dideuteroacetylene, 16: 20431
PLYUKHIN, V. V., Crystal structure of ($RbBe_3F_5$), 16: 20440
PLYUSHCHEV, V. E., Preparation of pure Cs and Rb compounds, 16: 20389
PNIEWSKI, J., Double emission of Li-8 fragments, 16: 21415
PNIEWSKI, J., Note on $_2$He-7 hyperfragments, 16: 21322
PNIEWSKI, T., Double emission of Li-8 fragments, 16: 21415
POBEDINSKII, N. M., Erythropoiesis in irradiated gravid animals, 16: 20190
PODESTA, Anna Maria, Oxidative phosphorylation in rats irradiated with Co-60, 16: 20286
PODESTA, Anna Maria, Serum protein levels in rats irradiated with Co-60, 16: 20287
PODGORETSKII, M. I., Singularities in kinetic equations, 16: 20639 (JINR-P-869)
POETZL, K., Fission products from Northern Alps, 16: 20883
POFFE, N., Excitation functions for (p,pn) reactions, 16: 21484
POFFE, N., Excitation functions for (p,xn) on gold, 16: 21485
POGOZINA, E. M., Salts of uranyl interaction with vegetable tissue, 16: 20090
POINT, J. J., Losses due to dead time of detectors, 16: 20792
POINTU, P., Glide elements of Be deformation, 16: 21045 (AEC-tr-5130)
POLAK, L. S., Gamma radiolysis of hexane, 16: 20512
POLAK, L. S., Transfer of energy in radiolysis, 16: 20491
POLAND, Duncan E., Thermodynamic properties of ions, 16: 20351 (ARL-191)
POLATTY, James M., Grout mixtures for Project Gnome, 16: 20046 (PNE-116F)
POLICARPO, A. J. P. L., Reaction $C^{13}(C^{13},\alpha)Ne^{20}$, 16: 21603
POLVANI, C., Intake of I-131 from milk in Italy, 16: 20127
POMERANCHUK, I., Theory of production of many particles, 16: 21270 (UCRL-Trans-825)
PONZ, F., Inhibition of selective absorption of sugars, 16: 20115
POPKOV, K. K., Biological protection against radiations, 16: 21696
POPOV, V. V., Radiation cataract from trauma, 16: 20165
POPOV, V. V., Ray cataract in the lens of the eye, 16: 20200
POPOVA, M. F., Reaction of muscle to radiation damage, 16: 20166
POPPOFF, I. G., Geophysical experiments pertinent to nuclear blackout—final rpt., 16: 20814 (NP-11603)
PORETTI, Guelfo G., Tritium incorporation in cell substances, 16: 20221
PORTER, K., Uranyl oxalate actinometer, 16: 20493
POSTON, A. M., Jr., Radioactive tracers in Be metallurgy, 16: 20950 (BM-RI-5980)
POTTER, R. A., Mixed oxide compounds containing BeO, 16: 20381
POUSSOT, R., 20 Mhz transistorized clock, 16: 20766
POWELL, D. G., Studies of organo-alkali and alkaline earth metal complexes. VII., 16: 20455
POWELL, J. E., Reaction of rare-earth ions with EDTA, 16: 20402
PRAGER, R., 1-Mv cascade generator, 16: 21655
PRATESI, A. Covino, Liquid diffusion in skin of irradiated animals, 16: 20213
PRATT, D. R., Prog. rpt. on biological effects of blast, 16: 20864 (DASA-1242)
PRAVEDNIKOV, A. N., Gamma-irradiated vinyl polymers, 16: 20486
PREDAZZI, E., Maximum analyticity principle, 16: 21306
PRENTKI, J., Unitary symmetry, 16: 21305
PREOBRAZHENSKAYA, E. I., Radiation effects on germination, 16: 20167
PREOBRAZHENSKAYA, E. I., Radiation resistance and phylogenetic system in plants, 16: 20169
PREOBRAZHENSKII, B. K., Ion exchange separation of rare-earth elements, 16: 20371 (AEC-tr-4457(p.187-9))
PRESTON, Jack, Prog. rpt. on Ta extrusion, 16: 20992 (ASD-TR-7-783)
PRIBILLA, O., Contamination of placenta with Sr-90, 16: 20107
PRICE, R. E., Neutron levels in the Zr region, 16: 21495
PRIMAK, William, Radiation damage, 16: 21085
PRITCHARD, Donald W., Radioactive wastes in marine environment, 16: 20082
PROKOSHKIN, Yu. D., Conserved vector current hypothesis, 16: 21321
PROSPERI, G. M., Ergodicity conditions in quantum mechanics, 16: 20940
PROWSE, D. J., $K^- + n \rightarrow \Lambda^0 + \pi^- + \pi^0$ at 765 Mev/c, 16: 21482
PROWSE, D. J., Sign of Σ hyperon nuclear potential, 16: 21483
PRUSOFF, William H., Sensitivity to uv of *Streptococcus faecalis*, 16: 20151
PUERSCHEL, Ute, Separation of In-111 from Cd targets, 16: 20551
PUGH, H. G., Binding energies of proton states in light nuclei, 16: 21487
PULLEN, D. J., Deuteron structure effects in low-Q stripping, 16: 21584
PUSHLENKOV, M. F., Extraction of uranyl nitrate, 16: 20542 (TRG-Inf-Ser-42)
PUTMAN, J. L., Counting rate in tracer experiments, 16: 20488
PYKA, M., Determination of Panofsky ratio, 16: 20683

Q

QUAIFE, Merton, Retention of Neohydrin-Hg-203, 16: 20113
QUERCIA, I. F., Positron annihilation in water, 16: 21175
QUILTY, J. H., Aerial prospecting, 16: 20822
QUINN, John J., Range of excited electrons in metals, 16: 21197
QUINTON, A. R., Reactions $Li^6(Li^6,d)B^{10}$ and $Li^7(Li^6,t)B^{10}$, 16: 21598

R

BABAUD, Madeleine, Electron spectra of phenanthrenes, 16: 20308

BABOY, S., Measurement of energy and intensity of γ rays, 16: 20628 (ANL-6499)

BADEKA, V., Determination of random event rate, 16: 20793

BADEKA, V., New counting circuits with E1T tubes, 16: 20802

BAHA, T. K., Possible resonance in Ξp reactions, 16: 21287

BAICATI, L. A., Selection rules for weak interactions, 16: 21298

BAIKEVICH, I. A., Magnetic-drum time analyzer, 16: 20779

BAJOVCICH, N., Prog. rpt. on flow balancing device in BWR, 16: 21820 (TID-15436)

BAJVANYI, P., Emission of deuterons and tritons and correlations in nuclei, 16: 21488

BAJALSKI, W., Preparation of Th–Zn alloys, 16: 20966

BAJAB, M. M., Hazards in radiodiagnosis, 16: 20892

BAJONE, David V., Uranium–Bi system, 16: 21071

BAJ, Kanti R., Therapy of multiple myeloma with Y-90, 16: 20070

BAK, K., Action of x radiation on uv thrombopoietic factor, 16: 20290

BAK, K., Thrombocytosis-producing action of serum of x-irradiated mice, 16: 20277

BAKHIMOV, R. R., Secondary emission from Mo, 16: 21156

BALEIGH, Douglas O., Reduction of Th oxide by Al, 16: 20424

BALKOVA, Jarmila, Measurement of low activities in water, 16: 20878 (AECL-1498)

BALLO, F., Absorption of UO_2^{++} on resin papers, 16: 20341

BAMAKRISHNAN, Alladi, Low-energy K^+-nucleon scattering, 16: 21296

BAMAKRISHNAN, Alladi, Possible resonance in Ξp reactions, 16: 21287

BAMAN, K., Low-energy K^+-nucleon scattering, 16: 21296

BAMANNA, R., Angular distribution of fission fragments, 16: 20736

BAMSDEN, S. A., Optical refractivity of free electrons, 16: 21673

BANDANELLI, E. G., Anomaly genesis in interkinetic nuclei, 16: 20215

BANDLES, J., Heat diffusion in cylindrical fuel elements, 16: 21712 (AEEW-R-96)

BAO, P. N. Rama, Angular distribution of fission fragments, 16: 20736

BAPP, Donald, Constants from transition-state theory, 16: 20418

BAPPERPORT, E. J., Prog. rpt. on refractory phase diagrams, 16: 21036 (NMI-9235)

BASKOVIC, D., Granulocyte peroxydases after irradiation, 16: 20161

BASMUSSEN, J. O., Alpha decay hindrance factors, 16: 21533

BASO, Dominic J., Monte Carlo calculations on scattered γ radiation, 16: 21693 (NP-11819)

BASTIN, B. C., Analysis of flash tube data, 16: 20679

BASTIN, B. C., Design of flash tube arrays, 16: 20680

BAUB, Ernst, Properties of fused and sintered Ta, 16: 21079

BAVIART, A., Characteristics of the 56 AVP photomultiplier, 16: 20725

BAY, William E., Effects of neutron capture on reactor control materials, 16: 21094 (NP-11708)

BAYMUND, M., Binding energy data from hypernuclei, 16: 21490

BAYSKI, Jerzy, Quantization of the gravitational field, 16: 21144

BAZ, B. J., Reactions (d,t) on isotopes of Ni, 16: 21557

BAZUMNAYA, E. G., Form of U in apatite, 16: 20825

BEADER, Paul D., Scale effects on ion rocket performance, 16: 21851

BEALE, A., Detection of neutral meson in H, 16: 20635 (ISS-61/7)

BEALE, A., Program for calculation of telescope angles, 16: 20636 (ISS-61/17)

BEBER, L. H., Proton polarization in deuteron stripping at 15 Mev, 16: 21597

BEBEYROTTE, Nicole, Radiochemical investigation of nucleic acids, 16: 20515

BECKNER, R., Prog. rpt. on radiacmeter research, 16: 20625 (AD-265927)

BEDDOCH, A. H., Nuclear magnetic resonance of Lu-175, 16: 21203

BEDDY, G. S., Spectra of $H_2C=C^{13}H_2$ and $H_2C=CHD$, 16: 20429

BEDONDO, D. M., Deuterons in nuclear matter, 16: 21403

BEED, J. W., Cratering experiments in desert alluvium, 16: 20049 (SC-4596(RR))

BEEVE, F. P., Cooling facility for reactor irradiations, 16: 21737

BEFFNER, John A., Thermal bleaching of Cl_2^- centers, 16: 20415

BEGGE, T., Maximum analyticity principle, 16: 21306

BEHM, Fred R., Plumbbob aerial-monitoring operations, 16: 20647 (WT-1485)

BEIBEL, K., Image-intensifier system, 16: 20719

BEIFFEL, L., Scintillation properties of alkali halides, 16: 20707

BEIFFEL, L., Studies on radiation-image detectors, 16: 20733

BEINES, F., Large Cherenkov detector, 16: 20711

BEINSTADLER, Rudolph, Technology of sintered stainless steel, 16: 21078

BEITER, R., Atmospheric contamination by fission products, 16: 20846

BEITER, R., Fission products from Northern Alps, 16: 20883

BESTELLI, G. B., Reaction $Be^9(n,\alpha)He^6$, 16: 21401

BEX, Dietrich, Operation of a Na circulation system, 16: 20576

BEXER, E., Electron beam welding, 16: 21000

BEYNOLDS, F. L., Prog. rpt. on chemistry, 16: 20305 (UCRL-10023)

BEYNOLDS, Jean H., Prog. rpt. on nuclear engineering, 16: 20042 (BNL-696)

BEZNIK, A. M., Extraction of Zr and Hf, 16: 20545

BEZNIKOVA, V. E., Properties of plutonium halides, 16: 20366 (AEC-tr-4457(p.10-19))

BHODES, D. N., Effect of irradiation on collagen, 16: 20182

BHODES, D. N., Treatment of meats with radiations. IX., 16: 20915

BHODES, J. R., Radioisotopes in instrument engineering, 16: 20912

BICCI, F. P., Crystal spectrometer, 16: 20678

BICCI, R. A., Levels in Sm-150 from Eu-150 decay, 16: 21396

BICHARDSON, D. J., Relocatable assembly system for IBM 1620, 16: 20928 (AAEC/E-87)

BICHARDSON, E. G., Conference on aerodynamic capture of particles, 16: 21224

BICHERT, R., Nuclear lifetimes with time-to-height converter, 16: 21440

BICHERT, Raymond, Plane polarization of AcC″ γ rays, 16: 21369

BICHMOND, D. R., Prog. rpt. on biological effects of blast, 16: 20864 (DASA-1242)

BICHTER, H., Constitution of Zr–Nb alloys, 16: 21061

BICHTER, H., Prog. rpt. on Zr–Nb alloys, 16: 20980 (EURAEC-26)

BICHTER, H., Prog. rpt. on Zr-Nb alloys, 16: 20981 (EURAEC-27)

BICHTER, H., Prog. rpt. on Zr–Nb alloys, 16: 20982 (EURAEC-85)

BICHTER, H. G., Flexible Geiger counters, 16: 20740

BIEDEL, Hans-Juergen, Cation exchange properties of inorganic materials, 16: 20356 (JUL-32-RC)

BIESE, Gretchen R., Direct transformation of thermal energy to electrical energy, 16: 21140 (AEC-tr-5048)

BIGBY, E. Bertrand, Diffusion of Co and Mg oxides, 16: 20395

BILEY, C. J., Analysis of seaweed for Ru-106, 16: 20322 (PG-Report-122)

BILEY, K. F., Binding energies of proton states in light nuclei, 16: 21487

BIMPAULT, M., Relative ΣΛ parity, 16: 21300

BIOU, M., Momentum distribution of protons in C-12 nucleus, 16: 21489

BISSET, J. C., Electro- and photodisintegration of O-16, 16: 21377

BITSON, D., Hodoscope performance and design, 16: 20772

BITTER, G. J., Nuclear magnetic resonance of Lu-175, 16: 21203

BITTER, Oskar L., Problems in shielding, 16: 20241

BOBBINS, A. B., Polarization of protons scattered from Ca, 16: 21544

BOBERTS, A., Cherenkov image detectors, 16: 20723

BOBERTS, A., LODESTAR—counter data-handling facility, 16: 20770

BOBERTS, A., Spark chamber spectrometer, 16: 20730

BOBERTS, J. H., Binding energy data from hypernuclei, 16: 21490

BOBERTS, L. D., Behavior of semiconductor detectors, 16: 20743

BOBERTS, Walter O., Energies of solar origin, 16: 20231

BOBERTSON, Daniel Stewart, Equipment for handling dangerous substances, 16: 20585

BOBERTSON, L. P., $O^{16}(p,\gamma)F^{17}$ direct radiative capture, 16: 21453

BOBILLARD, E., Incorporation of P-32 in heart, 16: 20091

BOBINSON, L. B., Coincidence pulse-amplitude analyzer, 16: 20776

BOBSON, J., Amines in inorganic hydrolysis, 16: 20434

BOBSON, William Selwyn, Fuel elements for nuclear reactors, 16: 21779

BOCARD, Yves, Depth effects on explosion seismic signals, 16: 20823

BOCH, A., Xenon poisoning of reactor, 16: 21741

BOCKWOOD, C., LODESTAR—counter data-handling facility, 16: 20770

BODE, A., Time-of-flight spectrometry of neutrons scattered by C, 16: 21378

BODENBERG, Rudolf, Two-quanta exchange in (e,ν) and (γ,ν) cross section, 16: 21469

BODWELL, William, Heat source and associated apparatus, 16: 21746

BODWELL, William, Improvements in nuclear reactors, 16: 21747

BOEBBELEN, G., Radiation effects on leaf color mutations, 16: 20207

BOEBBELEN, Gerhard, Ethyl methane sulfonate and x radiation in mutations, 16: 20208

ROESCHEL, Erich, Properties of fused and sintered Ta, 16: 21079
ROGERS, G. T., Decomposition of aqueous targets on pile irradiation, 16: 20466 (AERE-R-3409)
ROGERS, John D., Beta decay of Rb-86, 16: 21409
ROGERS, K. C., Capture of particles into stable betatron orbits, 16: 21651 (SIT-P53)
ROGUIN, Andre, Burst jacket detection in nuclear reactors, 16: 21783
ROGUIN, Andre, Fission products in gases, 16: 20692(P)
ROLLIER, M. A., Trends in nuclear chemistry, 16: 20484
ROMAND, Jacques, Emission source for continuous spectra, 16: 20448
ROMANENKO, P. N., Turbulent air flow in axisymmetrical channels, 16: 20606
ROMANO, A., Elastic scattering of $\pi^+ + p$, 16: 21293
ROMANOWSKI, T. A., Cherenkov image detectors, 16: 20723
ROMANOWSKI, T. A., Fermi-Teller Z-law, 16: 21174
ROMANOWSKI, T. A., Spark chamber spectrometer, 16: 20730
ROMIE, Fred E., Prog. rpt. on burnout heat flux with boiling water, 16: 20591 (ATL-A-113)
RONSICK, J. H., Fuel element flow blockage in ETR, 16: 21719 (IDO-16780)
ROOK, J. R., Distorted-wave analysis of (d,pγ) reactions, 16: 21553
ROOK, J. R., Two-stage decay mode of K^- mesic atoms, 16: 21534
ROOS, Matts, Optimal K^-p scattering conditions, 16: 21309
ROPERS, Jean, Improvements relating to reactors, 16: 21759
ROSA, R. J., Hall and ion slip effects in non-uniform gas, 16: 21119 (AFBSD-TR-61-80)
ROSA, R. J., Magnetohydrodynamic generator, 16: 21847 (AFOSR-2352)
ROSEN, Alan, Geomagnetically trapped radiation, 16: 20235
ROSEN, Gerald, Removal of free electrons in plasma, 16: 21679
ROSEN, Gerald, Symmetries of Einstein-Maxwell equations, 16: 21164
ROSENBAUM, J. B., Disposal of radioactive waste, 16: 21859 (BM-RI-6011)
ROSENBERG, D., Prog. rpt. on sputtering yields, 16: 21114 (AD-267458)
ROSEO, B., Radiation dose in heart x-ray investigation, 16: 20888
ROSS, Donald M., Radiation sources carried by space vehicle, 16: 20236
ROSTOKER, Norman, Rotation of plasmas in θ pinches, 16: 21681
ROSUEL, A., Influence on burnout flux of vortices induced in boiling water, 16: 20598 (EURAEC-146)
ROTA, A., Reaction $Be^7(n,\alpha)He^4$, 16: 21401
ROTARIU, George J., Prog. rpt. on analytical techniques, 16: 20324 (TID-15661)
ROTH, L. M., Bloch electrons in magnetic field, 16: 21176
ROTHLEITNER, J., Decay of bound muons, 16: 21611
ROUGE, Pierre, Improvements relating to nuclear reactors, 16: 21760
ROUSSET, P., Prog. rpt. on UC shaping and irradiation, 16: 20952 (EURAEC-71)
ROWE, D. J., Gamma rays from proton scattering from C, 16: 21468
ROWE, D. J., Reactions (n,np), (p,pn), and (p,2p) on C-12, 16: 21466
ROWE, D. J., Scattering of 150-Mev protons from Ca-40, 16: 21500
ROWE, L., Cerium oxides. V., 16: 20363 (NP-tr-893)
ROWLANDS, G., Resonance absorption, 16: 21340
ROZEN, A. M., Extraction of Zr and Hf, 16: 20545
RUBBIA, C., Muon capture in nuclei, 16: 21609
RUDENKO, T. I., Stability constants of $Ce(NO_3)_x$ ions, 16: 20370 (AEC-tr-4457(p.167-82))
RUDY, John F., Brazing of Mo sheet, 16: 20988 (ARF-2232-2)
RUEGG, H., Symmetries of strong interactions, 16: 21302
RUEHR, O. G., Interaction of EM fields with plasmas, 16: 21661 (AFCRL-746)
RUHLA, Ch., Momentum distribution of protons in C-12 nucleus, 16: 21489
RUMANOVA, I. M., Crystal structure of $Pr(NO_3)_3 \cdot 6H_2O$, 16: 20443
RUMLER, Shirod, Multichannel recording of a pulse spectrum, 16: 20761
RUMMEL, Walter, Uptake of V in *Ciona intestinalis*, 16: 20119
RUMPHORST, R. F., Particle identification system, 16: 20799
RUNGE, K., E1 transition probabilities in deformed odd-A nuclei, 16: 21458
RUPPEL, H. M., Nucleon-nucleon interaction, 16: 21473
RUSKOV, T., Energy spectrum of resonance absorption of γ rays in Zn-67, 16: 21362 (AEC-tr-5115)
RUSSELL, Paul L., Gnome pre- and post-shot mine survey, 16: 20048 (PNE-134F)
RUSSELL, R. D., Age of the Cuddapahs, India, 16: 20843
RUZICH, K. C., Hazards report on AGN-201 reactor, 16: 20862 (ANL-6510)
RYAN, C., Note on muon parity, 16: 21320
RYBICKA, M., Attenuation of Ta-181 133-482 kev cascade, 16: 21350 (NP-11602)
RYKALIN, V. I., Conserved vector current hypothesis, 16: 21321
RYTZ, A., Resonance, threshold, and natural α-particle energies, 16: 21630

S

SACHS, M., Heavy-ion-induced fragmentation studies, 16: 21634
SACHSE, G., Purification of radioactive waste materials. III., 16: 21865
SADDINGTON, K., Post-irradiation examination facilities at Windscale Works, 16: 21089 (DPR/INF/265)
SAEVHAGEN, Ruth, Irradiation of Drosophila males, 16: 20175
SAEVHAGEN, Ruth, X-ray sensitivity of Drosophila, 16: 20176
ST. LEGER-BARTER, Gerald, Calibration of P102 nuclear sensors, 16: 20632 (DC-59-6-743)
SAITO, Nobufusa, Hot-atom chemistry of halogens. II., 16: 20480
SAKAI, E., Semiconductor counter, 16: 20755
SAKAI, Mitsuo, EO transition probabilities, 16: 21445
SAKER, E. W., Neutron yield from Ti–T targets under deuteron bombardment, 16: 21358 (SERL-TR-M-61)
SAKURAI, Tsuneyoshi, Radiation malformations in the mouse fetus, 16: 20187
SALAM, A., Sakata model of unitary symmetry, 16: 21317
SALMON, G. L., Gamma rays from proton scattering from C, 16: 21468
SALMON, G. L., Reactions (n,np), (p,pn), and (p,2p) on C-12, 16: 21466
SALMON, G. L., Scattering of 150-Mev protons from Ca-40, 16: 21500
SALMON, J. E., Ammineruthenium(III) phosphates, 16: 20422
SAMARIN, A. [M.], Some problems of vacuum metallurgy, 16: 20967
SAMBELL, R. A., Microcrack growth in Mn oxide, 16: 20436
SAMPANTHAR, S., Binding energies of λ particles, 16: 21470
SAMSONOVA, N. N., Study of Fe–Al alloys, 16: 21056
SAMUEL, A. H., Geophysical experiments pertinent to nuclear blackout—final rpt., 16: 20814 (NP-11603)
SANCHEZ, R. T., Prog. rpt. on biological effects of blast, 16: 20864 (DASA-1242)
SANDERS, N. L., Mirror point densities in outer radiation zone, 16: 21244
SANDOR, T., Extensive air showers in air, 16: 21251
SANDOR, T., Muon intensity of cosmic radiation, 16: 21252
SANDULESCU, A., Tables of Clebsch-Gordan coefficients, 16: 21348 (IFA/FT/40)
SANDWINA, R., Prog. rpt. on radiacmeter research, 16: 20625 (AD-265927)
SANO, Hirotoshi, Hot-atom chemistry of halogens. II., 16: 20480
SANTUCCI, S., Recoil proton in $\gamma + p \to p + \pi^0$, 16: 21311
SARAZIN, A., Local characteristics of photomultipliers, 16: 20728
SARDESON, R. A., Prog. rpt. on radiacmeter research, 16: 20625 (AD-265927)
SATCHLER, G. R., Distorted-waves calculation of direct reaction, 16: 21579
SATCHLER, G. R., Energy dependence of the $B^{10}(d,p)B^{11}$ angular distribution, 16: 21559
SATCHLER, G. R., Nuclear reactions with polarized targets, 16: 21574
SAUDINOS, J., Inelastic scattering of 43-Mev α particles, 16: 21514
SAUERWALD, Franz, Zirconium-rich phases in Mg–Zr system, 16: 21044 (AEC-tr-5127)
SAUVE, Ch., Extrusion cladding of U–Zr, 16: 21001
SAVASHKEVICH, B. S., Cadmium sulfide γ-detectors, 16: 20663
SAVCHENKO, E. D., Treatment of radiation injuries, 16: 20278
SAVITSKII, E. M., Phase diagram of alloys of Mg–Nd, 16: 20372 (AEC-tr-4457(p.197-204))
SAWICKI, J., Giant E1 resonance for deformed nuclei, 16: 21524
SAWITSKY, Arthur, Therapy of multiple myeloma with Y-90, 16: 20070
SAWYER, Jerry Albert, Geometric buckling of cylindrical assembly, 16: 21330 (AD-267646)
SAXENA, G. P., Electrometric study on Th–arsenite system, 16: 20384
SAXENA, Ram Sahai, Electrometric study on Th–arsenite system, 16: 20384
SAXON, D. S., Shape of imaginary part of optical model potential, 16: 21540
SCARDINO, Vito, Rats infected with irradiated *Trichinella spiralis*,

16: 20135
SCARFONE, L. M., Many-body potentials in the Lee model. II., 16: 21304
SCHAD, James L., Space environment and its interactions with propellants, 16: 21845 (AD-266034)
SCHADE, H., Identification of B on Si, 16: 20346
SCHAEFER, E. A., Program for multiple lethargy level cell corrections for slab cells, 16: 21721 (MND-C-2500-2)
SCHAEFER, Hermann J., Radiation tolerance criteria in space, 16: 20882
SCHAEFFLER, O. S., Prog. rpt. on resins and elastomers, 16: 20350 (AGC-0423-01-3)
SCHALL, H., Hemoglobin formation in chick embryo, 16: 20260
SCHARFF-GOLDHABER, G., Properties of collective states in Os-186, 16: 21461
SCHARMANN, A., Dosimetry with LiF, 16: 21171
SCHARMANN, Arthur, Ion sources, 16: 20650 (NP-tr-894)
SCHEFER, Eli I., Nuclear fuel element, 16: 21004
SCHEIBLING, F., Transitions in O-16, 16: 21411
SCHENCK, Rudolf, Acid decomposition of Fe carbide, 16: 20377 (AEC-tr-5111)
SCHERBATSKOY, Serge A., Radioactivity well-logging system, 16: 20699
SCHERBATSKOY, Serge A., Temperature-regulated well-logging apparatus, 16: 20697
SCHEVE, William C., Calculation of thermal conductivity, 16: 21198
SCHIFF, H., Practical film dosimetry, 16: 20879 (NP-tr-904)
SCHILLER, Ralph, Structure-independent electrodynamics, 16: 21705
SCHINZ, Hans R., Radiation measurements in medical radiology, 16: 20900
SCHIRREN, Carl Georg, Resorption time of cutaneous wheals, 16: 20145
SCHLAUBITZ, K., Electron beam welding, 16: 21000
SCHLEICHER, H.-W., Prog. rpt. on Zr–Nb alloys, 16: 20980 (EURAEC-26)
SCHLEICHER, H.-W., Prog. rpt. on Zr–Nb alloys, 16: 20981 (EURAEC-27)
SCHLEICHER, H.-W., Prog. rpt. on Zr–Nb alloys, 16: 20982 (EURAEC-85)
SCHLEUTER, H., Balmer spectra in presence of h-f discharge, 16: 21143 (NP-tr-886)
SCHLUDI, H. N., Power density of compact reactors, 16: 21827
SCHLUEPMANN, K., Angular momentum quantum number of Ho-165, 16: 21379
SCHLUTER, R. A., Image-intensifier system, 16: 20720
SCHMID, Albrecht, Strontium metabolism in skeletal system, 16: 20118
SCHMID, E., Indistinguishability of nucleons and nuclear reactions, 16: 21623
SCHMID, Erich W., Nuclear many-body problems, 16: 21382
SCHMIDT, E. C. F., Radiation sterilization of food. II., 16: 20914
SCHMIDT, Erwin R., Localization of gastrointestinal hemorrhage, 16: 20058
SCHMIDT, F. H., Proton angular distributions for (α,p) reactions, 16: 21417
SCHMIDT, George, Plasma physics lecture notes. Chap. V., 16: 21667 (TID-15504)
SCHMIMNOVICH, Samuel, Foundations of quaternion quantum mechanics, 16: 21161
SCHMITT, K. H., Pressure gradient during gaseous diffusion, 16: 21141 (AEC-tr-5063)
SCHMITZ, F., Diffusion of fission product ions in UO_2, 16: 21046 (AEC-tr-5171)
SCHNABEL, Wolfram, Radiation reactions of polyvinyl acetates, 16: 20501
SCHNEIDER, Christel, Radiochemical polymerization of polymethylmethacrylate with acrylonitrile, 16: 20502
SCHNEIDER, W., E1 transition probabilities in deformed odd-A nuclei, 16: 21458
SCHOPPER, H. F., Validity of Rosenbluth formula, 16: 21313
SCHRAM, Eric, Radiochromatographic analysis of amino acids, 16: 20347
SCHROEDER, Diedrich, Strontium sorption in soils, 16: 20075
SCHROEDER, R. A., Inorganic carbonates and nitrates, 16: 20416
SCHUBERTH, Jan, Reduction of hemoproteins by uv irradiation, 16: 20146
SCHULERT, Arthur R., Strontium-90 assay of environmental materials, 16: 20870 (NYO-9934(Vol.III)Ext.)
SCHULZ, Guenther, Electron and ion saturation currents in gases, 16: 21686
SCHWARTZ, Melvin, Structure-independent electrodynamics, 16: 21705
SCHWARZ, E., Siemens Training Reactor SUR, 16: 21840
SCHWARZ, S., Angular distributions from reaction $Li^7(\alpha,n)B^{10}$, 16: 21602
SCHWARZER, Wolfgang, Protection against radiation effects in industry, 16: 20894
SCHWARZSCHILD, Arthur, Developments in delayed-coincidence measurements, 16: 21434
SCHWEMMLE, B., Radiation effects on leaf color mutations, 16: 20207
SCOCCIANTI, Paolo, Uptake of Sr-85 in man, 16: 20081
SCOTT, C. A., Defining desert environments, 16: 20821 (SC-4853(RR))
SCOTT, D. P., Cesium as fish and lamprey mark, 16: 20069
SCOTT, M., Prog. rpt. on producibility of Ti alloys, 16: 21016 (AD-266140)
SCOTTI-FOGLIENI, C., Anomaly genesis in interkinetic nuclei, 16: 20215
SEARCY, Alan W., Stability of solid phases, 16: 20394
SEBAOUN, Wilfrid, CsI(Tl) as fission fragment detector, 16: 20669
SECRETAN, L. F., Ion sources, 16: 20650 (NP-tr-894)
SEDLATSCHEK, Karl, Radiation shield structures, 16: 21006
SEEFELDT, W. B., Reactor decontamination, 16: 20303 (ANL-6477 (p.224-30))
SEELMANN-EGGEBERT, W., Chart of nuclides, 2nd ed., 1961, 16: 21430
SEGAR, A. M., Low-energy particles from CERN PS, 16: 21645 (CERN-62-19)
SEIDL, R., Emission of outer electrons, 16: 21142 (CEA-tr-A-1087)
SEIFEN, Ernst, Uptake of V in *Ciona intestinalis*, 16: 20119
SEITZ, Frederick, Solid state physics. XIII., 16: 21221
SEITZ, Frederick, Solid state physics. XI., 16: 21222
SEIYAMA, Takeyoshi, Electron micrographs of darkened ZnS phosphors, 16: 20477
SEIYAMA, Takeyoshi, ESR of irradiated glasses, 16: 20476
SEMIOKHIN (SEMIOKHIN), I. A., Separation of C isotopes by bicarbonate method, 16: 20925 (CEA-tr-R-1495)
SENENT, F., Development of nuclear emulsions. I., 16: 21145
SENGUPTA, D., Interaction of EM fields with plasmas, 16: 21661 (AFCRL-746)
SEPPI, E. J., Diffraction monochromator for study of nuclear resonance excitation, 16: 21443
SEREBRYAKOV, R. A., Particle entry into an emulsion chamber, 16: 20737
SEREBRYAKOVA, M. B., Form of U in apatite, 16: 20825
SERRANO C., Mario, Reconnaissance for U in Chile, 16: 20820 (RME-4568)
SETTI, R. Levi, Binding energy data from hypernuclei, 16: 21490
SEVAST'YANOV, O. Yu., Velocity and concentration of particles in plasma flow, 16: 21671
SHAH, S. K., Neutron-proton interactions in Li-6, 16: 21532
SHALEK, Robert J., Distribution of radiation in interstitial implantations, 16: 20112
SHALTIEL, D., Resonance of S-state ions in metals, 16: 21192
SHANK, E. M., Prog. rpt. on Eurochemic assistance program, 16: 20539 (ORNL-TM-246)
SHANNON, D. W., Zirconium oxide corrosion product, 16: 20979 (HW-71958-RD)
SHAPIRO, F. L., Energy spectrum of resonance absorption of γ rays in Zn-67, 16: 21362 (AEC-tr-5115)
SHARAPOVA, N. P., Chromatography of univalent ions. I., 16: 20457
SHARAPOVA, N. P., Chromatography of univalent ions. II., 16: 20458
SHARMA, C. S., Self-interaction in Thomas-Fermi potential, 16: 21212
SHCHERBAKOVA, A. S., Gamma radiolysis of hexane, 16: 20512
SHEDLOVSKY, J. P., Quartz for neutron activation studies, 16: 20336
SHEELY, W. F., Strain-aging in Nb alloys, 16: 21063
SHEID, Bertrun, X-ray spectroscopy in the clinical laboratory. VI., 16: 20331
SHELLEY, Robert, Diffusion of Co and Mg oxides, 16: 20395
SHELTON, H., Diffusion studies of Cs, 16: 21053
SHEPPARD, R. S., Performance of Ti in chemical plants, 16: 20983
SHERGALIS, Lawrence D., High-power microwave source, 16: 20662
SHERPING, F., Prog. rpt. on biological effects of blast, 16: 20864 (DASA-1242)
SHERR, R., Reaction (p,α) and seniority in the $f_{7/2}$ shell, 16: 21578
SHERRY, Edward Vincent, Jr., Concentration of Zr nitrate solutions, 16: 20465
SHERWOOD, R. C., Resonance of S-state ions in metals, 16: 21192
SHESTOPIEROV, V. J., Ionization pulses of cosmic radiation, 16: 21249
SHEWCHUCK, S., Quadrupolar and dipolar γ radiation of nuclei, 16: 21363 (UCRL-Trans-822(L))

SHEWCHUCK, Sergey, Theory of production of many particles, 16: 21270 (UCRL-Trans-825)

SHIEH, Tsh-jen, Influences of x-rays on rabbits, 16: 20209

SHIMIZU, Kiyoshi, Lung cancer among atomic bomb survivors. I., 16: 20266

SHIMIZU, Tsuneo, Trace elements in G-1 and W-1. II., 16: 20830

SHIPLEY, E. H., Binding energy data from hypernuclei, 16: 21490

SHKRABKINA, M. M., Solid solutions of Na and K hydrides, 16: 20388

SHMELEVA, N. I., Effects of radiation on hemopoiesis, 16: 20156

SHONO, Yoshihiko, ESR of irradiated glasses, 16: 20476

SHRIVASTAVA, B. J., Sudden commencements of geomagnetic storms, 16: 21230

SHTUKKENBERG, Yu. M., Natural radioactivity, 16: 20229

SHUVALOV, O. N., Extraction of uranyl nitrate, 16: 20542 (TRG-Inf-Ser-42)

SIDEBOTTOM, William Joseph, Shutting down of nuclear reactors, 16: 21756

SIDI, M., Transistor-driven decade counter tubes, 16: 20801

SIDORENKO, V. V., Nuclear radiation detectors, 16: 20689

SIEBENTRITT, C. R., Jr., Prog. rpt. on radiacmeter research, 16: 20625 (AD-265927)

SIEMINSKA, J., Double emission of Li-8 fragments, 16: 21415

SIENKO, M. J., Magnetic resonance of Li V Bronze, 16: 21123 (AFOSR-1959)

SIKKEMA, C. P., Energy levels in N-16, 16: 21394

SIKOV, Melvin R., Distribution of P-32 in rat, 16: 20110

SILVESTRINI, G. V., Recoil proton in $\gamma + p \rightarrow p + \pi^0$, 16: 21311

SIMIONESCU, Constantin, Metal-to-metal and ceramics-to-metal seals, 16: 20566 (IFA/TV/14)

SIMON, Ivan, Materials for vacuum insulation, 16: 20590 (ASD-TDR-62-88)

SIMONOFF, G. N., Excitation functions in Pa nuclei, 16: 21375

SIMONS, David G., Radiation heavier than C, 16: 20246

SIMONS, H. A. B., Localization of positron sources, 16: 20076

SIMONS, L., Gamma-γ directional correlations in Pb-208, 16: 21635

SIMPSON, Daniel E., Nuclear Superheat Meeting No. 5, 16: 21817 (TID-7630)

SIMPSON, F. B., Total neutron cross sections of Pa-231, 16: 21349 (IDO-16698)

SINANOGLU, O., Equilibrium properties of H_2, 16: 21177

SINGER, Leon, Binding of Ca and Sr, 16: 20111

SINITSYN, S. T., Effect of radiation on polyethylene insulation, 16: 20518

SISEMORE, C., Stress history measurements at Gnome, 16: 20808 (PNE-105P)

SKAKHRAY, V. A., Gamma radiolysis of hexane, 16: 20512

SKARSVAG, K., Gas scintillation counter, 16: 20715

SKJEGGESTAD, O., Binding energy data from hypernuclei, 16: 21490

SKLYANSKAYA, E. I., Effects of radiation on virus immunity, 16: 20227

SKRZYPCZAK, E., Fading in nuclear emulsions, 16: 20685

SLAPA, M., Scattering of 13-Mev deuterons on light nuclei, 16: 21566

SLAUS, I., Angular distributions from reaction $V^{51}(n,d)Ti^{50}$, 16: 21554

SLAUS, I., Scattering length (n-n) from D(n,p)2n, 16: 21472

SLAWSON, W. F., Age of the Cuddapahs, India, 16: 20843

SLEDZIEWSKI, Roman, Transistorized decade of an electronic counter, 16: 20676

SLEE, L. J., Ratio of neutron capture-to-fission for U-233, 16: 21372

SLEICHER, Charles A., Jr., Symposium on heat transfer, 16: 20613

SLOAN, Earl Law, III, Coupled electron and nuclear spin systems, 16: 21357 (RADC-TR-61-132)

SLOAT, R. J., Prog. rpt. on Eurochemic assistance program, 16: 20539 (ORNL-TM-246)

SLOBODRIAN, R. J., Interaction of deuterons with N, 16: 21355 (NP-11697)

SMETS, L. A., Radiation effects on cells, 16: 20204

SMIRNOV, R. V., Effect of γ dose on occurrence of ovarian tumors, 16: 20168

SMITH, Arthur W., Detection of electrons in β spectrometer, 16: 20645 (TID-15742)

SMITH, C. C., Magnesium alloys for fuel, 16: 21076

SMITH, C. L., Use of tritiated thymidine, 16: 20104

SMITH, D. A., Theoretical investigation of slit scattering, 16: 21639

SMITH, F. J., Thermal conductivity of atomic hydrogen, 16: 21209

SMITH, Hamilton, Arsenic in Napoleon's hair, 16: 20344

SMITH, J. R., Electron pairs from π^- mesons, 16: 21315

SMITH, Richard Edward, Improving resolution of Van de Graaff accelerator, 16: 21642 (AD-267612)

SMITH, S. E., Radioactive filtration systems, 16: 20575

SMITH, Tennyson, Hydrogen permeation of oxide films on Zr, 16: 21035 (NAA-SR-6267)

SMITHERS, S. R., Immunizing effect of irradiated cercariae, 16: 20202

SNOW, G., Low-energy particles from CERN PS, 16: 21645 (CERN-62-19)

SOBICZEWSKI, A., Calculation of optical potential, 16: 21477

SOBICZEWSKI, Adam, Calculation of the optical potential, 16: 21364

SOFER, George A., High vacuum technology, 16: 20315

SOFTKY, S. D., Geophysical experiments pertinent to nuclear blackout—final rpt., 16: 20814 (NP-11603)

SOKOL'CHIK, V. A., Organic loop in IRT-2000 Reactor, 16: 21841

SOKOLOVSKII, V. V., Magnetic-drum time analyzer, 16: 20779

SOKOLOWSKI, J., Transistor-driven decade counter tubes, 16: 20801

SOLANES, Mello M., Fast reactors over the world, 16: 21732

SOLTAN, M., Double emission of Li-8 fragments, 16: 21415

SOLTYNSKI, K., Double emission of Li-8 fragments, 16: 21415

SOMMER, L., Analytical groups for Ti(IV), 16: 20349

SOMOGYI, A., Extensive air showers in air, 16: 21251

SOMOGYI, A., Muon intensity of cosmic radiation, 16: 21252

SONDHEIMER, E. H., Boltzmann equation for anisotropic metals, 16: 21211

SOREGAROLI, D., Protective action of cardiac irradiation, 16: 20218

SOSNOVA, G. S., Detonation of mixed explosive substances, 16: 20375 (AEC-tr-5100)

SOSNOWSKI, R., Polarization of β rays from Na-24, Mn-56, Sb-122, Ho-166, and Au-198, 16: 21614

SOURIOUX, G., Influence on burnout flux of vortices induced in boiling water, 16: 20598 (EURAEC-146)

SOVENYI, E., Action of x radiation on uv thrombopoietic factor, 16: 20200

SPACH, Madison S., Radiation exposure in children, 16: 20890

SPACKMAN, R. A., Performance of scintillation counters, 16: 20714

SPANGLER, G. E., Prog. rpt. on high-purity Be, 16: 20958 (NP-11702)

SPANIER, J., Program for calculation of capture probabilities, 16: 20931 (WAPD-TM-273)

SPARROW, E. M., Slip flow in parallel plate channel, 16: 20620

SPECTOR, R. M., Beta decay of RaE, 16: 21412

SPEDDING, F. H., Reaction of rare-earth ions with EDTA, 16: 20402

SPEISER, D., Selection rules for weak interactions, 16: 21298

SPEISER, David, Foundations of quaternion quantum mechanics, 16: 21161

SPENCER, G. R., Effect of tumor materials on irradiated animals, 16: 20253

SPINDLER, H., Use of Al construction materials in power reactors, 16: 21829

SPIRCHEZ, M., Energy spectrum of γ rays. I., 16: 21389

SPITSYN, Vikt. I., Radiation effects on catalytic activity of Al oxide, 16: 20482

SPITSYN, Vikt. I., Atmospheric corrosion of "ARMCO" steel and carbon steel, 16: 21098

SPONSELLER, David L., Effect of γ' particle size on Ni alloys, 16: 21008 (AD-263483)

SPOONER, J. F., Crystal structure of ZrAl, 16: 21051

SPREADBOROUGH, J., Prog. rpt. on effects of radiation on pressure vessel steels, 16: 21090 (EURAEC-140)

SPREITER, John R., Effect of ring current on geomagnetic field, 16: 21246

SPRING, E., Gamma-γ directional correlations in Pb-208, 16: 21635

SPURRELL, Francis A., Binding of Ca and Sr, 16: 20111

STACH, V., Cooling gas flow in reactor, 16: 20603

STAJANO, A., Neutral particle decaying into $(\pi^+\pi^-\pi^0)$, 16: 21318

STANFORD, R. W., Gonad doses received by dental patients, 16: 20884

STANOJEVIC, D., Excitation functions of $V^{51}(p,n\gamma)Cr^{51}$, 16: 21626

STAPP, Henry P., Lectures on S-matrix theory, 16: 21267 (UCRL-9875 (Vol.2))

STARK, E., Hormones in x-ray-induced liver changes, 16: 20247

STARK, G., Excretion of Na and K after Ra treatment, 16: 20254

STAUB, H., Resonance, threshold, and natural α-particle energies, 16: 21630

STEENBERG, N. R., Nuclear scattering at high energies, 16: 21391

STEFFEN, R. M., Angular correlations of nuclear radiations, 16: 21351 (NP-11651)

STEFFENS, Hans-Dieter, Electric arc metal sputtering processes, 16: 20968
STEGEMANN, D., Radioisotopes in mechanical engineering research, 16: 20916
STEIN, Seymour, Spherical wave functions, 16: 20946
STEIN, W. A., Solar protons, α particles, and heavy nuclei, 16: 21239
STEKLY, Z. J. J., Magnetohydrodynamic generator, 16: 21847 (AFOSR-2352)
STENKHOFF, Robert, Acid decomposition of Fe carbide, 16: 20377 (AEC-tr-5111)
STEPHAN, E. F., Corrosion investigation of alloys, 16: 20974 (BMI-X-198)
STEPHEN, M. J., Charged Boltzmann gas at absolute zero, 16: 21216
STEPHEN, M. J., Shielding of nuclei by conduction electrons, 16: 21215
STEPHENS, G. A., $Li^7(\alpha,\gamma)B^{11}$ reaction, 16: 21427
STEPIN, B. D., Preparation of pure Cs and Rb compounds, 16: 20389
STEPINA, S. B., Preparation of pure Cs and Rb compounds, 16: 20389
STERN, David, Cosmic-ray variations during IGY, 16: 21242
STERNLICHT, B., Liquid shear transmission, 16: 20557 (AD-269396)
STEUNENBERG, R. K., Chemical-metallurgical processing, 16: 20297 (ANL-6477(p.29-105))
STEVENS, R. E., Data on rock samples G-1 and W-1, 16: 20833
STEVENSON, G. R., Intensity of primary cosmic-ray He nuclei, 16: 21254
STEWART, A. L., Physics of upper atmosphere, 16: 21121 (AFCRL-1062-I)
STEWART, P. B., Regional pulmonary function studied with Xe-133, 16: 20065
STIHI, M., Tables of Clebsch-Gordan coefficients, 16: 21348 (IFA/FT/50)
STILLINGER, Frank H., Jr., Correlations in classical order-disorder phenomena, 16: 21180
STIRLING, W. L., Ion beam neutralization, 16: 21152
STOCKMAN, Charles H., Electrostatic rocket propulsion, 16: 21858
STOKES, J. L., Behavior of graphite and Be, 16: 20809
STONE, F. S., Hydrogen–deuterium exchange, 16: 20433
STORK, D. H., $K^- + n \rightarrow \lambda^0 + \pi^- + \pi^0$ at 765 Mev/c, 16: 21482
STOSIC, N., Recovery effect of liver DNA injected into irradiated rats, 16: 20283
STOVALL, Marilyn, Distribution of radiation in interstitial implantations, 16: 20112
STOVALL, T., Determination of parity change, 16: 21556
STRAHL, H., Device for detection of H_2 in Na, 16: 20320 (NAA-SR-6986)
STRAUSS, H. E., Prog. rpt. on properties of carbons and graphites, 16: 21038 (NP-11665)
STREATER, R. F., Products of field operators, 16: 20939
STREET, Robert E., Symposium on heat transfer, 16: 20613
STRELKOV, A. V., Energy spectrum of resonance absorption of γ rays in Zn-67, 16: 21362 (AEC-tr-5115)
STRIMBEANU, I., Radiation in infection with pathogenic *staphylococci*, 16: 20257
STROHAL, P., Interaction of 14-Mev neutrons with nuclei, 16: 21586
STRZALKOWSKI, A., Scattering of 13-Mev deuterons on light nuclei, 16: 21566
STUART, R. V., Prog. rpt. on sputtering yields, 16: 21114 (AD-267458)
STUART, R. V., Sputtering yields at low ion energies, 16: 21116 (AD-267458(Pt.V))
STUMM, W., Criticality of U^{235}-impregnated cellulose, 16: 21258
STUPEGIA, D. C., Determination of nuclear constants, 16: 20302 (ANL-6477(p.217-23))
STUPEGIA, D. C., Neutron total cross section of U-233, 16: 21373
STURM, W. J., Hazards report on AGN-201 reactor, 16: 20862 (ANL-6510)
STUTZ, E., Radiation-induced epithelial cancinoma in rat lung. I., 16: 20147
STUTZ, E., Radiation-induced epithelial carcinoma in rat lung. II., 16: 20148
STYCZEN, J., g-Factor of state of Te-181, 16: 21414
SUCHORZEWSKA, J., Double emission of Li-8 fragments, 16: 21415
SUEN, Kwan-han, Photography of slow neutrons, 16: 20665
SUESS, H. E., Radiocarbon content of meteorites, 16: 20828
SUESS, H. E., Tritium content of meteorites, 16: 20827
SUGIMOTO, Ken'ichi, Radiation oxidation of Sn chloride, 16: 20479
SUGIMURA, Toshiko, Uranium in recent Japanese sediments, 16: 20844
SUGIMURA, Yukio, Uranium in recent Japanese sediments, 16: 20844
SUGIURA, Masaru, Theta pinch device, 16: 21669
SUKORUCHKIN, S. I., Multichannel time analyzer, 16: 20780
SUNDARAM, V. K., Radioactive equilibrium, 16: 21345 (AEET/HP/4)
SUTTER, G., Transitions in O-16, 16: 21411
SUTTON, Alice, Availability to man of Sr in milk, 16: 20899
SUTTON, R. B., Fermi-Teller Z-law, 16: 21174
SVELTO, O., Signal-to-noise in nuclear magnetometer, 16: 20682
SWAIN, C. Gardner, Intimate ion pairs, 16: 20399
SWAINE, D. J., Trace elements in G-1 and W-1, 16: 20831
SYMCHOWICZ, S., Excretion of radioactivity, 16: 20084
SZATAI, I., Effect of x rays on guinea pig, 16: 20252
SZILAGYI, T., Effect of x rays on guinea pig, 16: 20252
SZULC, P., Graphite reflector in VVRS "EWA" reactor, 16: 21842
SZYMCZYK, S., Attenuation of Ta-181 133-482 kev cascade, 16: 21350 (NP-11602)

T

TABATA, Tatsuo, Nonobstructive electron beam monitor, 16: 20653
TABATA, Tatsuo, Secondary electron monitor. I., 16: 20652
TACHON, J., Delayed neutrons in "Proserpine", 16: 21739
TAFFARA, L., Axiomatic dispersion relations, 16: 21307
TAGAKI, Waichiro, Hydrogen–deuterium exchange reactions, 16: 20306
TAHER-ZADEH, M., $K^- + n \rightarrow \lambda^0 + \pi^- + \pi^0$ at 765 Mev/c, 16: 21482
TAI, Yuan-Kwei, Production of D_2O by electrolytic method, 16: 20926
TAI, Yuan-kwei, Yield and distribution of neutrons from Zr–T target, 16: 21371
TAI, Yun-kwei, Cockcroft-Walton accelerator as neutron source, 16: 21654
TAKATA, Kanae, Blood patterns in radiation therapy of uterine carcinoma, 16: 20264
TAKETANI, Hiroshi, Inelastic proton scattering, 16: 21393
TALMI, I., Level spectrum of O-18, 16: 21365
TAMAMI, M. Y., Iodine-131 in sheep and cattle thyroids in Egypt, 16: 20125
TAME, K. E., Disposal of radioactive waste, 16: 21859 (BM-RI-6011)
TANANAEV, I. V., Uranyl ferrocyanides, 16: 20367 (AEC-tr-4457(p.69-79))
TANDARDINI, D., Intermediate arithmetic memory, 16: 20768
TANG, Y. C., Cluster model calculations in light nuclei, 16: 21496
TANG, Y. C., Generalized cluster wave functions, 16: 21398
TANNER, N. W., Giant dipole resonance in O-16, 16: 21510
TANNER, N. W., Giant dipole resonance in Ca-40, 16: 21511
TANNER, N. W., Inelastic scattering from collective nuclei, 16: 21504
TARASOVA, Z. N., Radiation vulcanization, 16: 20481
TARRAGO, Xavier, Reaction (p,αxn) on Th, 16: 21374
TARREGA, P., Development of nuclear emulsions. I., 16: 21145
TASCHOW, Hans-Joachim, Zirconium-rich phases in Mg–Zr system, 16: 21044 (AEC-tr-5127)
TATE, Cecil, Regge trajectories for single attractive Yukawa potential, 16: 21268 (UCRL-10140)
TATTERSALL, H. G., Microcrack growth in Mn oxide, 16: 20436
TAVERNA, L., Protective action of cardiac irradiation, 16: 20218
TAYLOR, A. M., Magnesium alloys for fuel, 16: 21076
TAYLOR, Anthony James, Improvements in nuclear reactors, 16: 21773
TAYLOR, D. M., Fission products in drinking waters, 16: 20126
TAYLOR, K. J., Decomposition of aqueous targets on pile irradiation, 16: 20466 (AERE-R-3409)
TAYLOR, Mary P., Fission products in drinking waters, 16: 20126
TAYLOR, Roland, Production of metals (Th and Pu), 16: 20533
TAYLOR, Walter J., Control rod actuator mechanism, 16: 21789
TELBISZ, F., Meon intensity of cosmic radiation, 16: 21252
TELEGDI, V. L., Muon capture rates for Ca-44 and Ca-40, 16: 21399
TELEGDI, V. L., Muon capture by F-19, 16: 21400
TELEGDI, V. L., Spin dependence of interaction responsible for muon capture, 16: 21610
TELSON, David R., Film developing envelope, 16: 20584
TENNEY, G. H., Behavior of graphite and Be, 16: 20809
TERA, F., Distribution of U(VI) between alcohol–nitric acid, 16: 20548
TEREKHOVA, V. F., Phase diagram of alloys of Mg–Nd, 16: 20372 (AEC-tr-4457(p.197-204))
TERTOOLEN, J. F. W., Packing of liquids for irradiation, 16: 20574
TESTA, C., Separation of rare earths. I., 16: 20546
TETTAMANZI, N., Dynamics of cubic crystals, 16: 21186
TGETGEL-SCHELLING, C., Determination of D in H_2O, 16: 20333
THANKAPPAN, V. K., Collective vibrations in even-even nuclei, 16: 21494

THENARD, J., Binary number comparator, 16: 20767
THENARD, J., Time coding with binary scaler, 16: 20769
THENARD, J., 20 MHz transistorized clock, 16: 20766
THIMOTEE, Janine, Irradiation and ovarian grafts, 16: 20139
THIRION, J., Inelastic scattering of 43-Mev α particles, 16: 21514
THOMAS, A. O., Light mass yields in neutron fission of U-235, 16: 21347 (AWRE-O-58/61)
THOMAS, G. C., Giant dipole resonance in O-16, 16: 21510
THOMAS, G. C., Giant dipole resonance in Ca-40, 16: 21511
THOMAS, J. G., Electron pairs from π^- mesons, 16: 21315
THOMAS, Richard, Effect of irradiation on healing of wounds in albino rat, 16: 20289
THOMPSON, A. J., Tantalum in the granite G-1, 16: 20832
THOMPSON, M. G., Track location in triggered spark counters, 16: 20684
THOMPSON, S. G., Alpha decay scheme of Am-242m, 16: 21518
THOMSON, John F., Protection and treatment of mammals, 16: 20242
THORPE, Percy Eric, Improvements in electromagnetic flowmeters, 16: 20624
THUNGA, R., Possible resonance in Ξp reactions, 16: 21287
TICHO, H. K., $K^- + n \rightarrow \lambda^0 + \pi^- + \pi^0$ at 765 Mev/c, 16: 21482
TIDAU, G., Radioactive marking of cable defects, 16: 20910 (CEA-tr-A-1052)
TIDWELL, Eugene D., Infrared spectrum of dideuteroacetylene, 16: 20431
TIEN, C. L., Model for nucleate pool boiling, 16: 20605
TIKHOMIROV, I. A., Electrosynthesis of ozone, 16: 20463
TIMOFEEV-RESOVSKII, N. V., Radiation effects on germination, 16: 20167
TIMOFEEV-RESOVSKII, N. V., Radiation resistance and phylogenetic system in plants, 16: 20169
TINT, G. S., Prog. rpt. on high-purity Be, 16: 20958 (NP-11702)
TIOMNO, J., Dirac equation in general relativity, 16: 21701
TISHECHKINA, A. S., Processing data from multi-channel analyzers, 16: 20771
TISSIER, J. M., Selectors with magnetic memory, 16: 20774
TIXAIRE, Alberto Golindo, Scattering general analysis, 16: 21146
TKALICH, V. S., Motion of high-temperature plasma, 16: 21672
TOBIAS, Cornelius A., Particulate radiation, 16: 20245
TODD, H. A., Fast-neutron spectrometer, 16: 20745
TODO, Naoyuki, Effect of γ radiation on methanol decomposition, 16: 20516
TOHYAMA, T., Radiation-pulse transmission, 16: 20800
TOKUDA, T., Sides of a nuclear-powered ship, 16: 20573
TOKUNAGA, Tsugihiko, Atomic bomb radiation cataract in Nagasaki, 16: 20133
TOLMACHEVA, N. S., Cerium-activated vitreous scintillators, 16: 20716
TOLSTOY, I., Sturm-Liouville equation, 16: 20942
TOMAS, P., Angular distributions from reaction $V^{51}(n,d)Ti^{50}$, 16: 21554
TOMBRELLO, T. A., Cluster model interpretation of energy width, 16: 21543
TOMINAGA, Takeshi, Hot-atom chemistry of halogens. II., 16: 20480
TOMONAGA, Masanobu, Blood picture of Nagasaki survivors, 16: 20248
TOMONAGA, Masanobu, Hematological studies on survivors in Nagasaki, 16: 20249
TOMONAGA, Masanobu, Leukemia of Nagasaki atomic bomb survivors, 16: 20251
TOMPKINS, F. C., Nitridation of Li, 16: 20456
TONOLINI, F., Cross section of $Si^{30}(n,\alpha)Mg^{27}$, 16: 21413
TOROPOV, N. A., Syathetic Sc silicates, 16: 20444
TOTH, F., Effect of x rays on guinea pig, 16: 20252
TOTH, K. S., Distribution and ranges of N-13 particles, 16: 21416
TOTH, K. S., Single-nucleon reactions induced by 28-Mev N-14 ions, 16: 21575
TOYODA, Shigeki, Leukemia of Nagasaki atomic bomb survivors, 16: 20251
TRAENKLE, H. L., Reduction of scatter radiation, 16: 20569
TRAIL, C. C., Measurement of energy and intensity of γ rays, 16: 20628 (ANL-6499)
TRAUTMANN, Johannes, Effects of radiation on white mice. I., 16: 20288
TREHARNE, P. I., Tensile deformation of Be, 16: 21062
TRENTA, A., Anomaly genesis in interkinetic nuclei, 16: 20215
TRETYAKOVA, C. A., Ionization pulses of cosmic radiation, 16: 21249
TRILLING, Leon, Plane linear MHD waves, 16: 21160
TRIULZI, C., Separation of rare earths. I., 16: 20546
TRUBEY, K. K., Program for computing γ transmission through slabs, 16: 20931 (ORNL-TM-167(Rev.))
TRUCCO, R., Separation of inorganic ions in fused salts, 16: 20550
TSAI-CHU, Proton-nucleon collisions, 16: 21286
TSANG, Tung, Sign of the Li-8 magnetic moment, 16: 21419
TSIKLIS, S., Measurement of I-131 in irradiated Te, 16: 20489
TS'OU (TSOU), Chu-liang (Chzhu-lyan), Discharge in a spark chamber along particle track, 16: 20638 (JINR-D-870)
TSUCHIHASHI, Gen-Ichi, Intimate ion pairs, 16: 20399
TSUCHITA, Hiro, Polymerization of oxetanes by radiation, 16: 20503
TSUKAHARA, Iwao, Trace elements in G-1 and W-1. II., 16: 20830
TSUMORI, Kunihiko, Calorimeter for intense electron beams. I., 16: 20[illegible]
TSUZUKU, T., Prog. rpt. on properties of carbons and graphites, 16: 20[illegible] (NP-11665)
TSYBUL'SKII (TSYBUL'SKIY), I. B., Pathogenesis of radiation injuries of skin, 16: 20132 (JPRS-13644)
TU, Chen-chun, Investigation on manufacture of portable Geiger counter, 16: 20666
TUBBS, M. R., Radiation effects on KCl crystals, 16: 21105
TUCHMANN-DUPLESSIS, H., Congenital malformations, 16: 20210
TUCKER, W. D., Production of Te-132, I-132, Mo-99, and Tc-99m, 16: 20544
TUNAZIMA, Nagatoshi, Theory of radiation in matrix form, 16: 21709
TUNNICLIFFE, P. R., Protective system design for reactors, 16: 21[illegible] (AECL-1495)
TURANSKAYA, N. V., Rare earths in Ural peridotite, 16: 20835
TURBA, F., Hemoglobin formation in chick embryo, 16: 20260
TURKIN, A. D., Measuring β sources by ionization chambers, 16: 20[illegible]
TURNBULL, David, Solid state physics. XIII., 16: 21221
TURNBULL, David, Solid state physics. XI., 16: 21222
TURRISI, E., Positron annihilation in water, 16: 21175
TWINN, K., Gonad doses received by dental patients, 16: 20884
TYAPKIN, A. A., Discharge in a spark chamber along particle track, 16: 20638 (JINR-D-870)

U

UDO, F., Discrimination in organic scintillation crystals, 16: 20788
UDO, F., Particle identification system, 16: 20799
UEBERALL, H., Reactions induced by neutrinos, 16: 21425
UNNA, I., Effective interactions in deformed nuclei, 16: 21501
UNTERBERG, Walter, Gravity problems in space powerplants, 16: 21[illegible]
URAY, L., Extensive air showers in air, 16: 21251
USPENSKAYA, T. A., Thorium mineral resources, 16: 20852
UTHE, P. M., TORY II-A design, 16: 21822 (UCRL-6305)

V

VACEK, Antonin, Survival of rats after exposure to x rays, 16: 20280
VAIDYA, P. C., Wave solutions in general relativity. I., 16: 21207
VALDEZ, E. G., Disposal of radioactive waste, 16: 21859 (BM-RI-6011)
VALIN, J., Properties of silicon n-i-p junctions, 16: 20748
VALLIS, D. G., Light mass yields in neutron fission of U-235, 16: 21[illegible] (AWRE-O-58/61)
VALLURI, S. R., High stress level fatigue, 16: 20805 (ARL-181)
VANCE, E. F., Geophysical experiments pertinent to nuclear blackout—final rpt., 16: 20814 (NP-11603)
VANDAKUROV, Yu. V., Stability of plasma cylinder, 16: 21670
VAN DER STRICHT, E., Prog. rpt. on fall-out at Mol, 16: 20812 (A/AC.82/G/L.711)
VAN DER STRICHT, E., Prog. rpt. on fall-out at Mol, 16: 20813 (A/AC.82/G/L.721)
VAN DE VORST, A., ESR in irradiated DNA, 16: 20195
VAN HOUTEN, G. R., Water-gas reaction in vapor plating alumina, 16: 20352 (DC-59-3-200)
VAN HOVE, L., Quantum theory of many-particle systems, 16: 21223
VAN KLAVEREN, J. A., Labeling hydrocarbons, 16: 20490
VAN LEUVEN, P., Copper isotopes by the unified model, 16: 21397
VAN LIESHOUT, R., Levels in Sm-150 from Eu-150 decay, 16: 21396
VAN LINT, V. A. J., Prog. rpt. on radiation effects on Si solar cells, 16: 21092 (GACD-3001)

VAGHINI, V., Anomaly genesis in interkinetic nuclei, 16: 20215
VAN HOOIJEN, B., Levels in Sm-150 from Eu-150 decay, 16: 21396
VARDYA, M. S., Equilibrium properties of H_2, 16: 21177
VARGA, G., Radioactive fertilizers. I. phosphates, 16: 20475 (CEA-tr-X-434)
VARLEY, J. H. O., Vacancies generated by fast neutrons, 16: 21103
VARTAPETIAN, H. A., Nature of 686-kev level of Re-187, 16: 21383
VASIL'EVA, I. A., Thermodynamics of W oxides, 16: 21055
VASIL'EVA, V. A., Synthetic Sc silicates, 16: 20444
VASSALLO, C., Radiation effects on salivary glands, 16: 20216
VASSALLO, C., Radiation effects on salivary glands, 16: 20217
VASSEUR, J., Windowless photomultipliers, 16: 20724
VASUDEVA, B. R., Detailed flow field in transition, 16: 20614
VATSEK, A., Consumption of O_3 in irradiation, 16: 20192
VAUGHN, F. J., Reaction $C^{13}(He^3,n_0)O^{15}$ and $C^{14}(He^3,n_0)O^{16}$, 16: 21595
VENHART, J., Radiation doses from administered radionuclides, 16: 20152
VENTURINI, G., Reaction $Be^9(n,\alpha)He^4$, 16: 21401
VERBA, J., Reaction $C^{13}(d,n)N^{14}$, 16: 21589
VERHEULEN, Theodore, Separation by adsorption methods, 16: 20316
VESTINE, E. H., Preliminary reverse impulse of storms, 16: 21229
VIEKNA, Ya., Stability of pulse amplifier gain, 16: 20783
VIKTUZOV, D. V., Plastic scintillators, 16: 20717
Vil'gel'mi, Z.
see Z. Wilhelmi
VILLANI, S., Production of U-235 and D_2O, 16: 20936
VILLAR, E., Development of nuclear emulsions. I., 16: 21145
VILLARD, O. G., Jr., Solar flare of September 28, 1961, 16: 21233
VINGIANI, G. B., Levels in Sm-150 from Eu-150 decay, 16: 21396
VINH MAU, Nicole, Collective states of O-16 and C-12, 16: 21520
VINNIK, M. I., Proton magnetic resonance of solutions, 16: 20464
VINOGRADOV, V. P., Electron temperature of plasma in strong shock wave, 16: 21668 (AERE-Trans-893)
VIR SUD, Lekh, Forbush decreases at different latitudes, 16: 21253
VISKANTA, R., Boiling from a liquid-liquid interface, 16: 20617
VISVANATHAN, S., Properties of relativistic electron gas, 16: 21675
VITALE, B., Low-energy nucleon-nucleon interaction, 16: 21480
VITALE, B., Neutral particle decaying into ($\pi^+\pi^-\pi^0$), 16: 21318
VIZI, I., Liquid scintillation counters, 16: 20709
VOITOVETSKII, V. K., Cerium-activated vitreous scintillators, 16: 20716
VOLF, Vladimir, Internal radiostrontium contamination, 16: 20077
VOLKOVA, M. A., Colloid Au in treatment of lung cancer, 16: 20099
VOLMAN, D. H., Uranyl oxalate actinometer, 16: 20493
VOLODINA, G. F., Crystal structure of $Pr(NO_3)_3 \cdot 6H_2O$, 16: 20443
VON ARDENNE, M., Duoplasmatron as injector of ions or electrons, 16: 20649 (FTD-TT-62-480)
VON DEM BUSSCHE, Gerd Freiherr, Strontium sorption in soils, 16: 20075
VON REICHENBACH, Heinrich Graf, Strontium sorption in soils, 16: 20075
VORE, E., Prog. rpt. on radiacmeter research, 16: 20625 (AD-265927)
VOROB'EVA, O. V., Effect of radiation on semiconductor films, 16: 21107
VORTMAN, L. J., Cratering experiments in desert alluvium, 16: 20049 (SC-4596(RR))
VOSKOBOINIKOV, G. V., Effects of radiation on hemopoiesis, 16: 20156
VOSKOBOINIKOV, I. M., Detonation of mixed explosive substances, 16: 20375 (AEC-tr-5100)
VOZNYUK, E. I., Radiophosphorus in diagnosis of neoplasms, 16: 20073
VRETAS, T., Prog. rpt. on producibility of Ti alloys, 16: 21016 (AD-266140)

W

WACHSMANN, Felix, Effects of radiation on rat testes, 16: 20225
WADDELL, C. N., Neutron yields from 32-Mev protons, 16: 21479
WAEFFLER, H., Radiative capture of deuterons in Be-9 and C-12, 16: 21638
WAENKE, H., Radiocarbon content of meteorites, 16: 20828
WAENKE, H., Tritium content of meteorites, 16: 20827
WAGNER, Gustav, Damage by dermatological roentgen therapy, 16: 20223
WAGNER, Henry N., Jr., Synthesis of Co-57 tetraphenylporphinesulfonate, 16: 20072
WAHLIG, M., Cylindrical spark counter, 16: 20731
WAINE, Peter, Refueling machines for reactors, 16: 21749
WAKEFIELD, A. W., Transistorized preamplifier, 16: 20795
WALBANK, Thomas, Apparatus for treating inert gas, 16: 20580
WALDMANN, L., Pressure gradient during gaseous diffusion, 16: 21141 (AEC-tr-5063)
WALECKA, J. D., Level spectrum of O-18, 16: 21365
WALI, K. C., Production of new heavy bosons, 16: 21291
WALKER, L. A., Assay of C-14 in compounds or mixtures, 16: 20335
WALKER, Richard I., Leukocyte kinetics, 16: 20062
WALKER, W. D., Production of Y_1^* and K^* in π-p collisions, 16: 21289
WALKINSHAW, W., Corrected dimensions for MRC accelerator, 16: 21643 (AERE-Memo-G/M-37)
WALLACE, Duane C., Anharmonic contributions to specific heat, 16: 21185
WALLACE, Roger, Particulate radiation, 16: 20245
WALLMANN, J. C., Prog. rpt. on chemistry, 16: 20305 (UCRL-10023)
WALOSCHEK, P., Elastic scattering of $\pi^+ + p$, 16: 21293
WALTER, F. J., Behavior of semiconductor detectors, 16: 20743
WALTON, Alan, Studies of nuclear debris in precipitation, 16: 20816 (NYO-9531)
WANG, Chen-ying, Mutation in rice induced by x radiation, 16: 20179
WARBURTON, E. K., Proton capture transitions, 16: 21452
WARHURST, E., Studies of organo-alkali metal complexes. V., 16: 20453
WARHURST, E., Studies of organo-alkali and alkaline earth metal complexes. VI., 16: 20454
WARHURST, E., Studies of organo-alkali and alkaline earth metal complexes. VII., 16: 20455
WARNER, G. T., Plastic phosphor well counter, 16: 20658
WASSEN, Anders, Arsenic in Napoleon's hair, 16: 20344
WASSERMANN, Gooster, Growth and orientation of needle-shaped W crystals, 16: 21083
WATANABE, Bunro, Leukemia of Nagasaki atomic bomb survivors, 16: 20251
WATANABE, Misao, Lung cancer among atomic bomb survivors. I., 16: 20266
WATERFIELD, R. L., Calculation of distance factors for reactor sites, 16: 21726 (TID-14844)
WATSON, B. M., Prog. rpt. on radiacmeter research, 16: 20625 (AD-265927)
WATSON, R. E., Magnetic and spectroscopic properties of rare-earth ions, 16: 21128 (MRL-118)
WATT, D. E., Radioactivity among isobaric pairs, 16: 21405
WATTENBERG, A., Neutral particles in 30° beam from AGS, 16: 21650 (NP-11624)
WATTS, H. V., Scintillation properties of alkali halides, 16: 20707
WATTS, T. L., Energy level selection in neutron transfers to Pb isotopes, 16: 21536
WEBB, P. P., Silicon junction particle detectors, 16: 20674
WEBBER, W. R., Heavy nuclei in primary cosmic radiation, 16: 21241
WEBER, George, Apparatus for irradiating liquids, 16: 20920
WEBER, K. H., Sensitivity of Geiger-Mueller counters. I., 16: 20656
WECHSLER, Alfred E., Materials for vacuum insulation, 16: 20590 (ASD-TDR-62-88)
WEED, R. D., Evaluation of nuclear reactor decontaminants, 16: 20984
WEEKS, Ivan F., Closed-cycle water-boiler reactor, 16: 21786
WEEKS, John R., Proceedings of 11th Annual AEC Corrosion Symposium, 16: 20975 (BNL-728)
WEGNER, H. E., Coulomb-distorted (d,p) angular distributions, 16: 21580
WEGNER, H. E., Semiconductor detector systems, 16: 20746
WEHNER, G. K., Physical sputtering, 16: 21115 (AD-267458(Pt.I))
WEHNER, G. K., Prog. rpt. on sputtering yields, 16: 21114 (AD-267458)
WEIGAND, Maribert, Lymphocytic chorioneningitis in mice. I., 16: 20271
WEIGAND, Maribert, Lymphocytic chorioneningitis in mice. II., 16: 20272
WEIGOLD, E., Isomeric cross section ratios, 16: 21385
WEIL, N. A., Brittle behavior of ceramic materials, 16: 21020 (ARF-8203-18)
WEINGARTNER, Harold C., High vacuum technology, 16: 20315
WEINSTEIN, Daniel, Prog. rpt. on Zr alloys, 16: 20973 (ARF-2198-18)
WEIR, C. E., Inorganic carbonates and nitrates, 16: 20416
WEISFUSE, Louis, Therapy of multiple myeloma with Y-90, 16: 20070
WEISHAAR, Julius, Radiation resistance in cervical carcinoma, 16: 20174
WEISNER, L. Earl, Transistor circuits for remote BF$_3$ counters, 16: 20634 (DP-692)
WEISS, J. W., Mammary hypoplasia after irradiation, 16: 20170
WEISSKOPF, V. F., CERN and high-energy physics. II., 16: 21653
WEISSKOPF, Victor F., Relativistic quantum mechanics lectures,

16: 21699 (CERN-62-15)
WELLS, Ronald Alfred, Improved phosphorylated cellulose, 16: 20311
WELSH, R. E., Fermi-Teller Z-law, 16: 21174
WELWART, Y., Lithium and Li-6 analysis by counting delayed neutrons, 16: 20318 (IA-690)
WENDE, S., Sarcoma of frontal bone after x-ray therapy, 16: 20171
WENDNAGEL, Th., Neutron scattering cross section of H_2O, 16: 21342
WENG, Tu-lung, Strength of thick-walled pressure vessels, 16: 21735
WENZEL, W. A., Polarization in π–p scattering, 16: 21323
WERLE, J., S matrix description of decays, 16: 21617
WERNICK, J. H., Resonance of S-state ions in metals, 16: 21192
WERTHEIM, G. K., Iron-57 Mossbauer resonance, 16: 20404
WEST, D., Reaction (p,n) Q values in β decay, 16: 21615
WESTERLUND, S., Probes for plasma research, 16: 20661
WESTON, Ralph E., Jr., Constants from transition-state theory, 16: 20418
WESTWATER, J. W., Boiling of liquids, 16: 20313
WESTWOOD, A. R. C., Dislocations in Li fluoride, 16: 20437
WHAPHAM, A. D., Formation of dislocation loops in Cu, 16: 21102
WHIPPLE, Fred L., Particulate contents of space, 16: 20233
WHITE, C. S., Prog. rpt. on biological effects of blast, 16: 20864 (DASA-1242)
WHITE, D. H., Image-intensifier system, 16: 20719
WHITE, P. A. S., Radioactive filtration systems, 16: 20575
WHITEHEAD, A. B., Deuteron structure effects in low-Q stripping, 16: 21584
WHITESIDE, D., Nimrod external proton beam, 16: 21649 (NIRL/R/12)
WHITFIELD, W. J., Cleanroom design, 16: 20874 (SC-4673(RR))
WHITHEAD, A. B., Semiconductor counters, 16: 20752
WHITTEN, R. C., Geophysical experiments pertinent to nuclear blackout—final rpt., 16: 20814 (NP-11603)
WHITTON, J. L., Radiation damage in pure Al, 16: 21101
WIBBERNEZ, G., Protons, muons, and electrons in cosmic radiation, 16: 21256
WICKENBERG, Gunilla, Instrumentation for pulse spectroscopy, 16: 20753
WIDEROEE, Rolf, Radiation measurements in medical radiology, 16: 20900
WIEDERHORN, Norman M., Space environment and its interactions with propellants, 16: 21845 (AD-266034)
WIKNER, E. G., Prog. rpt. on radiation effects on Si solar cells, 16: 21092 (GACD-3001)
WILDE, Frederick, Fuel elements for nuclear reactors, 16: 21765
WILDE, R. E., Infrared spectrum of CH_3SiH_3 and Cl_2SiD_2, 16: 20428
WILDERMUTH, K., Cluster model calculations in light nuclei, 16: 21496
WILDERMUTH, K., Generalized cluster wave functions, 16: 21398
WILDERMUTH, K., Indistinguishability of nucleons and nuclear reactions, 16: 21623
WILDY, P., Use of tritiated thymidine, 16: 20104
WILHELMI, Z., Polarization of β rays from Na-24, Mn-56, Sb-122, Ho-166, and Au-198, 16: 21614
WILHELMI (VIL'GEL'MI), Z., Radioactivity of slags used in building materials, 16: 20871 (PAN-269/1-A)
WILKINSON, D. H., Deuteron structure effects in low-Q stripping, 16: 21584
WILKINSON, D. H., Structure of the nuclear surface, 16: 21528
WILKINSON, J. B., Plasma jet as plasma source for advanced propulsion systems, 16: 21659 (AD-267135)
WILLERMOZ, H., Corrosion of Zy by H_2O or steam, 16: 20985
WILLIAMS, C. W., Pulse characteristics of phototubes, 16: 21437
WILLIAMS, D. L., Radiocarbon in plant products, 16: 20079
WILLIAMS, D. N., Tensile properties of binary Ti–Zr and Ti–Hf alloys, 16: 21058
WILLIAMS, H. J., Resonance of S-state ions in metals, 16: 21192
WILLIAMS, R. L., Silicon junction particle detectors, 16: 20674
WILLIAMS, Rollie B., Spectrometer, 16: 20704
WILLIAMS, T. Ffrancon, Radiation chemistry of α-pinene, 16: 20497
WILLIAMS, T. Ffrancon, Radiation chemistry of β-pinene, 16: 20498
WILLIS, J. B., Matrix elements for tritons, 16: 21284
WILLIS, W., Low-energy particles from CERN PS, 16: 21645 (CERN-62-19)
WILLMOTT, J. C., Energy levels of Na-23, 16: 21498
WILLMOTT, J. C., $Li^7(\alpha,\gamma)B^{11}$ reaction, 16: 21427
WILMORE, D., Structure of mass 18 nuclei, 16: 21631
WILSON, C. G., Crystal structure of ZrAl, 16: 21051
WILSON, David J., Pressure dependence of fluorescence spectra. III., 16: 20406
WILSON, G. L., Heats of formation of Nb and Ta pentabromides, 16: 20491
WILSON, W. A., Triplet excitation induced by electron irradiation. II., 16: 20467 (ASD-TDR-62-32(Pt.II))
WILSON, W. E., Jr., Transistorized preamplifier, 16: 20795
WILSON, W. L., Performance of Ti in chemical plants, 16: 20983
WINCIERZ, P., Constitution of Zr–Nb alloys, 16: 21061
WINCKLER, J. R., Solar flare x-ray burst, Sept. 1961, 16: 21238 (NP-11658)
WINKELMAN, James, Synthesis of Co-57 tetraphenylporphinesulfonate, 16: 20072
WINKLER, H., Resonance, threshold, and natural α-particle energies, 16: 21630
WINN, S. M., Adaptation of mouse bone marrow, 16: 20282
WINSTON, R., Muon capture rates for Ca-44 and Ca-40, 16: 21399
WINSTON, R., Muon capture by F-19, 16: 21400
WINTERS, D. F., Instrument valves for flow measurement and sampling system, 16: 20631 (CVNA-140)
WISECUP, William G., Fall-out and livestock, 16: 20124
WOELFLI, W., Photoneutrons from Be-9, 16: 21410
WOJTKOWSKA, J., Polarization of β rays from Na-24, Mn-56, Sb-122, Ho-166, and Au-198, 16: 21614
WOLF, N. S., Fetal production of cells, 16: 20160
WOLFENDALE, A. W., Track location in triggered spark counters, 16: 20684
WOLFF, Etienne, Competition between anlage of tibia and fibula in chick embryo, 16: 20164
WOLFSBERG, Max, Dehydration of formic acid, 16: 20398
WOLICKI, E. A., Angular correlations in $B^{10}(He^3,py)C^{12}$, 16: 21568
WOLICKI, E. A., Cluster effects in nuclear reactions, 16: 21572
WOLICKI, E. A., Reaction $C^{13}(He^3,\alpha\gamma)C^{12}$, 16: 21571
WOLMARANS, N. S., Scattering of cosmic ray muons, 16: 21248
WONG, James, Prog. rpt. on Ta extrusion, 16: 20992 (ASD-TR-7-783(III))
WOO, Fe-yueh, Photography of slow neutrons, 16: 20665
WOOD, G. T., Gamma cascades in Pb-208, 16: 21392
WOOD, J. D. L. H., Neutron yield from Ti–T targets under deuteron bombardment, 16: 21358 (SERL-TR-M-61)
WOODCOCK, E. R., Wood density measurements in criticality clearance of transport containers, 16: 20861 (AHSB(S)R-36)
WOODHEAD, T., Nuclear capture of polarized muons, 16: 21426
WOOTTON, William Robert, Reactor charging arrangements, 16: 21774
WORT, D. J. H., Directional coupler in oversize waveguide, 16: 20671
WRIGHT, D. J., Facility for whole-body irradiation, 16: 20078
WU, Tai Tsun, Impedance as a causal operator, 16: 21277
WYATT, A., NPD-2, Canada's prototype power reactor, 16: 21832

Y

YAKEL, H. L., Mixed oxide compounds containing BeO, 16: 20381
YALCH, J. P., Shield computer program 18-0, 16: 21691 (DC-60-7-9)
YAMADA, Masasuke, Polymerization of oxetanes by radiation, 16: 20503
YAMADA, Tosaburo, Theta pinch device, 16: 21669
YAMAGATA, S., Sides of a nuclear-powered ship, 16: 20573
YAMAMOTO, Osamu, Angular distribution of neutron flux of T(d,n) reaction apparatus, 16: 21370
YAMAMOTO, Ryuichi, Trace elements in G-1 and W-1. II., 16: 20830
YANDUSHKIN, K. N., Atmospheric corrosion of "ARMCO" steel and carbon steel, 16: 21098
YANKO, W. H., Prog. rpt. on shielding materials, 16: 21690 (AD-267561L)
YANKWICH, Peter E., Dehydration of formic acid, 16: 20398
YARYMOVYCH, M. I., Arcjet-propelled spacecraft, 16: 21854
YATES, M. J. L., Heavy ion excitation of Pd-108 and Pd-110, 16: 21516
YATES, M. J. L., Oxygen ion excitation in Ru-102, Ru-104, Pd-106, Cd-112, and Cd-114, 16: 21517
YATSIV, S., Rare earth ions in crystals, 16: 21205
YEN, Wu-kuang (IAN' U-guan), Energy spectrum of resonance absorption of γ rays in Zn-67, 16: 21362 (AEC-tr-5115)
YEOMANS, Clive M., Control rod acturator mechanism, 16: 21789
YING, Sheng-k'ang, Gamma-irradiated vinyl polymers, 16: 20486
YNTEMA, J. L., Angular correlations in scattering of protons from Mg-24,

16: 21561
YNTEMA, J. L., Energy dependence of the $B^{10}(d,p)B^{11}$ angular distribution, 16: 21559
YNTEMA, J. L., Reaction (α,t) on nuclei, 16: 21558
YNTEMA, J. L., Reactions (d,t) on isotopes of Ni, 16: 21557
YNTEMA, J. L., Reaction (d,He^3) near Z = 28, 16: 21562
YNTEMA, J. L., Scattering of α particles by Ni-58 and Ni-60, 16: 21421
YNTEMA, J. L., Scattering of 43-Mev α particles in the Ni region, 16: 21560
YOBLIN, J. A., Prog. rpt. on Be forging, 16: 20991 (ASD-TR-7-647(VI))
YOCCOZ, J., Emission of deuterons and tritons and correlations in nuclei, 16: 21488
YODER, V. E., Reduction of scatter radiation, 16: 20569
YOSHIDA, S., Two-nucleon stripping reaction, 16: 21604
YOSHIDA, Toshio, Electron micrographs of darkened ZnS phosphors, 16: 20477
YOSHIDA, Toshio, ESR of irradiated glasses, 16: 20476
YOSHIDA, Toshio, Luminescence of ZnS:Cu, Cl, 16: 21150
YOSHIKAWA, Kazuko, Measurement of Cs-137 concentration, 16: 20123
YOSHIKAWA, Kazuko, Observation of fall-out, 16: 20121
YOSHIKAWA, Kazuko, Radioactive air-borne dusts, 16: 20122
YOSHIKAWA, Kazuko, Radiochemical waste evaporator system, 16: 21861
YOSHINAGA, Heruma, Angular distribution of neutron flux of T(d,n) reaction apparatus, 16: 21370
YOSHIZAWA, Yasukazu, Study of Cd isotopes. I., 16: 21380
YOSHIZAWA, Yasukazu, Study of Cd isotopes. II., 16: 21381
YOUMANS, Arthur H., Compensation of density logging instruments, 16: 20698
YOUNG, James E., Spectrum of two-particle excitations, 16: 21522
YOUNG, Jonathan D., Application of linear programming to linear differential equations, 16: 20932 (UCRL-10110)
YOUNG, L., Spin matrix exponentials, 16: 21707
YOUNG, R. A., Geophysical experiments pertinent to nuclear blackout—final rpt., 16: 20814 (NP-11603)
YTTERBORN, Karl H., X-ray sensitivity of spermatogonia, 16: 20197
YUDINA, V. G., Extraction of Pu(IV) with TBP, 16: 20369 (AEC-tr-4457 (p.161-6))
YUDINTSEVA, E. V., Accumulation of fission products in crops, 16: 20885

Z

ZABELIN, P. A., Rules for nuclear power plants, 16: 20903
ZABIYAKIN, G. I., Multi-measuring tape-recording systems, 16: 20764
ZABORENKO, K. B., Migration of radioactive isotopes produced in α decay, 16: 20373 (AEC-tr-4457(p.281-93))
ZADORY, E., Hormones in x-ray-induced liver changes, 16: 20247
ZAIDEL, A. N., Luminescence of salts of rare earths, 16: 20378 (AEC-tr-5112)
ZAIMAN, Herman, Rats infected with irradiated *Trichinella spiralis*, 16: 20135
ZAIMAN, Herman, Rats infected with *Trichinella spiralis* larvae, 16: 20137
ZALESKI, C. P., Fast reactors over the world, 16: 21732
ZALESKI, C. P., Spectral analysis of fast neutrons, 16: 21338
ZALKIND, Ts. I., Determination of γ radiation dosage, 16: 20880 (CEA-tr-R-1572)
ZAMBETTI, E., Radiation effects on salivary glands, 16: 20217
ZANNONI, G., Counter with reduced wall effect, 16: 20739
ZAORALEK, Peter, Tritium incorporation in cell substances, 16: 20221
ZAPF, C. F., Friction and wear of metallided surfaces, 16: 21029 (DC-60-1-146)
ZAPPASODI, Peter, Biphasic response in resistance to tuberculosis in rabbits, 16: 20068
ZARAKHANI, N. G., Proton magnetic resonance of solutions, 16: 20464
ZAREMBO, Yu. I., Thorium mineral resources, 16: 20852
ZARICHNY, James, Acoustic-gravity wave propagation, 16: 20838
ZARIF'YANTS, Yu. A., Oxygenated complexes on the surface of graphite, 16: 20387
ZAUDERER, Bert, Confinement of partially ionized gas, 16: 21677
ZAYRAT'YANTS, V. B., Pathogenesis of radiation injuries of skin, 16: 20132 (JPRS-13644)
ZEIDMAN, B., Angular correlations in scattering of protons from Mg-24, 16: 21561
ZEIDMAN, B., Energy dependence of the $B^{10}(d,p)B^{11}$ angular distribution, 16: 21559
ZEIDMAN, B., Reaction (d,He^3) near Z = 28, 16: 21562
ZEIDMAN, B., Scattering of α particles by Ni-58 and Ni-60, 16: 21421
ZEIDMAN, B., Scattering of 43-Mev α particles in the Ni region, 16: 21560
ZEMANIAN, A. H., Properties of transfer functions. II., 16: 21219
ZEPKO, G. W., Capture of particles into stable betatron orbits, 16: 21651 (SIT-P53)
ZHDANOV, V. M., Transport properties of partially ionized gas, 16: 21682
ZHELEZNYAKOV, V. V., Radiation of electromagnetic waves, 16: 21316
ZHUKOV, G. P., Liquid scintillation counters, 16: 20709
ZHUKOV, G. P., Multi-measuring tape-recording systems, 16: 20764
ZHURAVLEV, N. N., Preparation of metallic Cs, 16: 20374 (AEC-tr-4457 (p.294-8))
ZHURIN, V. V., Electron temperature of plasma in strong shock wave, 16: 21668 (AERE-Trans-893)
ZHUROV, Yu. (Iu.) A., Separation of C isotopes by bicarbonate method, 16: 20925 (CEA-tr-R-1495)
ZIEDMAN, B., Reactions (d,t) on isotopes of Ni, 16: 21557
ZIELINSKA, M., Calculation of optical potential, 16: 21477
ZIELINSKA, Malgorzata, Calculation of the optical potential, 16: 21364
ZIERING, S., Theoretical hydromagnetic shocks, 16: 21662 (AFSWC-TDR-62-42)
ZILINSKI, E., Dissociation of H_2^+ and H_3^+ ions in accelerator, 16: 21656
ZLATIN, N., Prog. rpt. on machining refractory materials, 16: 20990 (ASD-TR-7-532(VI))
ZMIJEWSKA, Wanda, Determination of Cu, As, and Sb, 16: 20345
ZONIS, Irwin Samuel, Concentration of Zr nitrate solutions, 16: 20465
ZOTOV, G., Possible spectrochemical source, 16: 20304 (CRL-73)
ZUCKER, A., Single-nucleon reactions induced by 28-Mev N-14 ions, 16: 21575
ZUFALL, John H., Fission product applications using β sources, 16: 20471 (NYO-9485)
ZUPPINGER, Adolf, Tritium incorporation in cell substances, 16: 20221
ZWANZIGER, D. E., Analyticity in complex angular momentum of S matrix, 16: 21698 (AFOSR-2400)
ZWICKER, U., Constitution of Zr–Nb alloys, 16: 21061
ZWICKER, U., Prog. rpt. on Zr–Nb alloys, 16: 20982 (EURAEC-85)
ZWICKER, U., Prog. rpt. on Zr–Nb alloys, 16: 20981 (EURAEC-27)
ZYCH, W., Resonance, threshold, and natural α-particle energies, 16: 21630

SUBJECT INDEX

Main entries in this index are generally specific materials, things, and processes. These are followed by modifiers that describe the properties of, and processes applied to, the main entries. A more complete description of the patterns and style of indexing used is included in the introductions to the subject index cumulations that are issued quarterly.

As an aid to the users of this index, references to report numbers, where appropriate, are included after the abstract number of the citation.

The number preceding the colon is the *NSA* volume number, and the number following is the abstract number in that volume. The designation (R) following the abstract number indicates that the abstract is of a progress report; (P) indicates a patent; and (T) indicates a translation. Abstracts for reports other than progress reports carry no letter designation. Published literature (journal article or book) is identifiable by the absence of a report number.

A

ABSTRACTS
of theses on nuclear chemistry, 16: 20305(R) (UCRL-10023)
on stainless steel stress-corrosion cracking, 16: 20978 (DP-683)
ACCELERATOR TUBES
dissociation of hydrogen ions in, 16: 21656
ACCELERATORS
beam pulse-height analysis, charge storage techniques for, 16: 20760
injection system design, 16: 21644 (CERN-62-4)
perturbation theory, 16: 21648 (MURA-634)
research programs at CERN, 16: 21653
ACETAMIDE, *N,N*-DIMETHYL-
complexes with uranium tetraperchlorate, 16: 20420
ACETATES
radiation effects, measurement of amount and composition of radiation products, 16: 20466 (AERE-R-3409)
ACETIC ACID, (ETHYLENEDIAMINE)TETRA-
analytical use in measuring uranium burnup, 16: 20317 (HW-72199)
reactions with rare earth ions in aqueous solution, calorimetric studies, 16: 20402
ACETIC ACID, FLUORO-
protective effects of salt against radiation on *Escherichia freundii*, 16: 20144
ACETIC ACID–2-PENTANONE, 4-METHYL—WATER SYSTEMS
electric conductivity, 16: 20534(R) (IDO-14574)
ACETIC ACID, VINYL ESTER
radioinduced polymerization and polymer degradation, effects of linear energy transfer of radiations, 16: 20501
ACETONE
boiling, hydrodynamic model for nucleate pool, 16: 20605
ACETYLENE
effects on radiolytic formation of hydrogen from silane, 16: 20478
radioinduced polymerization, effects of electric fields on, 16: 20471 (NYO-9485)
spectra of dideuterated, infrared, 16: 20431
ACRYLONITRILE POLYMERS
radiation effects on polymerization processes and rates, 16: 20483
radiolysis, determination of free radical production by electron paramagnetic resonance, 16: 20486
ACRYLONITRILES
polymerization with pre-irradiated polymethylmethacrylate, 16: 20502
ACTINIC RADIATIONS
detection and measurement, development of instrument using uranyl oxalate for, 16: 20493
energies of solar, 16: 20231
ACTINIDES
electronic 5f wave functions, and atomic radii, 16: 21212
ACTINIUM
separation from elements, with atomic numbers 89 to 95 by paper chromatography, 16: 20340
ACTIVATION ANALYSIS
equipment, evaluation of quartz crystals for, 16: 20336
of light elements with charged particles, 16: 20321 (NP-11608)
use of He^3-induced reactions for oxygen, 16: 20305(R) (UCRL-10023)
use to determine arsenic distribution in Napoleon's hair, 16: 20344
ADHESIVES
development of high-temperature structural, 16: 20959(R) (NP-11703)
ADRENAL GLANDS
radiation effects on medullary layer, internal low dose, 16: 20191
ADRENAL HORMONES
effects on radiation effects in liver in rat, 16: 20247
ADRENALINE
arrhythmic effects, protective action of cardiac irradiation against, 16: 20218
radiation effects on urinary excretion by rats, 16: 20173
AERIAL SURVEYING
instrument development for Plumbbob Operation, 16: 20647 (WT-1485)
AGE ESTIMATION
of commercial products, use of radioisotopes, 16: 20909 (TID-15034)
of elements, galaxy, solar system, and universe using radioisotopes, 16: 21606
AIR
cosmic shower attenuation length in, 16: 21251
electric conductivity at 2000 to 7000°K, effects of seeding with low ionizing potential substances, 16: 21663 (ARL-62-310)
heat transfer and resistance in turbulent flow, 16: 20606
heating 0.2 pounds per second to 3100°F, design of system for, 16: 20560 (DC-59-6-253)
heating 10 pounds per second to 3500°F, design of gas dynamic system for, 16: 20559 (DC-59-5-41)
monitoring, 1961, 16: 20906
monitoring, 1961 and 1962, 16: 20907
proton scattering near 100 kev, ionization cross sections, 16: 21218
radioactivity measurement apparatus, 16: 20693(P)
radioactivity monitoring, apparatus, 16: 20694(P)
radiological monitoring, 1961, 16: 20905
ALANINE, *N*-ACETYL-
radiation effects on electron spin resonance, double quantum transition, 16: 20513
ALBUMINS
transmission from mouse mother to fetus, radiation effects, 16: 20067
ALCOHOLS

analytical effects on distribution of uranium between nitric acid solutions and Dowex resin, 16: 20548
ALGAE
radiation tolerances in photosynthesis, 16: 20238
radioinduced mutations in *Chlamydomonas reinhardi* from ultraviolet light, 16: 20203
ALKALI METAL–ALKALI METAL HALIDE SYSTEMS
solubility and nature of bonding in fused, 16: 20400
ALKALI METAL COMPOUNDS
reactivities and spectra of complexes with anils, imines, hydrocarbons, and nitro compounds, 16: 20453
ALKALI METAL HALIDE CRYSTALS
scintillation properties at low temperatures, 16: 20707
ALKALI METALS
containers for, evaluation of niobium–tungsten alloy, 16: 21037(R) (NP-11614)
properties for increasing electric conductivity of magnetohydrodynamic gases, 16: 21663 (ARL-62-310)
ALKALINE EARTH COMPLEXES
preparation, reactivities, and spectra, 16: 20454
ALKALINE EARTH METALS
properties for increasing electric conductivity of magnetohydrodynamic gases, 16: 21663 (ARL-62-310)
ALKYL HALIDES
radiolysis, study, 16: 20472(R) (RRL-79)
ALLOYS
radiation effects on metastable beta phase, 16: 20954(R) (NMI-2104)
ALPHA DECAY
hinderance factors in, 16: 21533
of transplutonium elements, study, 16: 20305(R) (UCRL-10023)
tables of Clebsch-Gordan coefficients, 16: 21348 (IFA/FT-40)
ALPHA PARTICLES
angular distributions from deuteron reactions (d,α) with aluminum-27 at 10 Mev, 16: 21515
angular distributions from nitrogen-14 reactions with oxygen 16 at 27.2 Mev, 16: 21625
biological effects on nerve fibers from frog skin, 16: 20134
biological effects on *Escherichia coli*, 16: 20140
chemical effects on polyvinyl acetate, dependence on linear energy transfer, 16: 20501
detection and measurement, semiconductor detector systems for, 16: 20746
detection and measurement, use of thallium-activated cesium iodide foil, 16: 20669
detection and performance at low levels, ionization chambers for, 16: 20735
effect on homozygous yeast, 16: 20226
energy levels, Monte Carlo calculations of Schödinger equation for ground state, 16: 21537
ionization of argon mixtures by, at 5.14 Mev, 16: 21136 (TID-15708)
properties of, from neutron reactions (n,α) with beryllium-7 at thermal energies, 16: 21401
reactions (α,n) with beryllium-9 at 5.35 Mev, angular correlations in, 16: 21601
reactions (α,n) with lithium-7 at 13.5 to 13.9 Mev, angular distributions from, 16: 21602
reactions (α,n) with potassium-39, positron decay of scandium-42 formed in, 16: 21636
reactions (α,n) and (α,3n) with silver-107 and 109, indium-110 production from, 16: 21381
reactions (α,t) with nuclei, forward-peaking transitions in, 16: 21558
reactions on medium nuclei, gamma distributions from, 16: 21457
reactions with noble gases, emission spectra excitation, 16: 21147
reactions with nuclei at 10^{12} ev/nucleon, angular distributions, 16: 21404
scattering by medium-weight nuclei at 43 Mev, excitation of collective levels in, 16: 21514
scattering by nickel-58 and -60 at 43 Mev, elastic and inelastic, 16: 21421
scattering by nickel-60 at 43 Mev, angular distributions to excited states, 16: 21560
scattering by tin-116, characterization of 1.28 and 2.23 Mev levels from, 16: 21499
scattering by vibrational nuclei, mathematical analysis, 16: 21125(R) (ANL-6517)
ALPS MOUNTAINS (EUROPE)
fall-out monitoring of precipitation, grass, and glaciers in 1960, 16: 20883
ALUMINUM
crystal structure, 16: 20380
determination in rare earth oxides, spectrographic method for, 16: 20327
gamma absorption coefficients at 0.14 to 2.76 Mev, 16: 21695
nuclear spin-lattice relaxation in, containing small amounts of germanium or zinc at 0.37 to 1.2°K, 16: 21184
performance in two-fluid magnetohydrodynamic cells, 16: 21151
positron decay in, half life, 16: 21439
properties as x-ray filter, 16: 20086
properties for increasing electric conductivity of magnetohydrodynamic gases, 16: 21663 (ARL-62-310)
proton reactions (p,γ), resonance energies in, 16: 21630
radiation effects, studies by transmission electron microscopy, 16: 21101
reduction of thorium oxide, equilibrium in, 16: 20424
sputtering with electric arc, characteristic stages, 16: 20968
use as construction material in water-cooled power reactors, survey, 16: 21829
ALUMINUM (LIQUID)
density, 16: 21041(R) (TID-15663)
ALUMINUM–CHROMIUM–COBALT–MOLYBDENUM–NICKEL–TITANIUM ALLOYS
strength, effects of severe stress and thermal histories, 16: 21023 (ASD-TR-61-194)
ALUMINUM–CHROMIUM–IRON ALLOYS
use in thermocouples, 16: 20633 (DC-59-10-202)
ALUMINUM–CHROMIUM–NICKEL ALLOYS
properties at high temperatures, effects of γ' particle size, 16: 21008 (AD-263483)
ALUMINUM COMPLEXES
with 3-cyanopentane-2,4-dione, stretching frequency of cyano group in, 16: 20421
ALUMINUM–COPPER ALLOYS
grain-boundary sliding, 16: 21024 (ASD-TR-61-383)
meson (μ^-) capture probabilities, 16: 21174
ALUMINUM CRYSTALS
grain-boundary sliding, 16: 21024 (ASD-TR-61-383)
ALUMINUM–IRON ALLOYS
phase studies and physical properties in Fe,Al region, 16: 21056
ALUMINUM ISOTOPES Al-25
energy levels, asymmetric-core collective model for, 16: 21459
energy levels, lifetimes, 16: 21440
ALUMINUM ISOTOPES Al-26
energy levels, lifetimes, 16: 21440
ALUMINUM ISOTOPES Al-27
alpha reactions (α,p), proton angular distributions, 16: 21417
deuteron reactions (d,α) at 10 Mev, evidence for (2I+1) rule in, 16: 21515
deuteron reactions (d,p) at 15 Mev, angular dependence of proton polarization in, 16: 21597
energy level schemes, intrinsic states in, 16: 21407
energy levels, branching ratio to 2.2 Mev from silicon-27 ground state, 16: 21519
fluorine isotope reactions (F^{19},F^{18}) up to 43 Mev, 16: 21428
gamma scattering, properties of giant resonance, 16: 21456
ALUMINUM ISOTOPES Al-28
energy levels, lifetimes, 16: 21440
ALUMINUM–MAGNESIUM ALLOYS
grain-boundary sliding, 16: 21024 (ASD-TR-61-383)
radiation effects, studies by transmission electron microscopy, 16: 21101
ALUMINUM–MOLYBDENUM–TITANIUM–VANADIUM ALLOYS
creep properties, effects of sheet processing variables, 16: 21009(R) (AD-264815)
ALUMINUM OXIDE COMPACTS
thermal expansion at −200 to 0°C, 16: 21057
ALUMINUM OXIDE FILMS
electric conductivity of thin, 16: 21010(R) (AD-264878)
production by vapor plating effects of water-gas reactions, 16: 20352 (DC-59-3-200)

radiation effects on, applied to glass, 16: 21108
ALUMINUM OXIDES
corrosion by hydrofluoric acid solutions, 16: 20042(R) (BNL-696)
formation in fluidized-bed waste calciners, 16: 20535(R) (IDO-14583)
radiation effects on catalytic activity in dehydration of, 16: 20482
sorption of boric acid by, 16: 21839(R) (IDO-16760)
ALUMINUM–SILVER ALLOYS
tensile properties, effects of beryllium particles dispersion, 16: 21019(R) (ARF-2212-5)
ALUMINUM SULFATES
effects on mammalian amylase activity, 16: 20061
ALUMINUM–THORIUM ALLOYS
free energy of formation of $ThAl_4$, 16: 20424
ALUMINUM–TIN–TITANIUM–ZIRCONIUM ALLOYS
creep properties, effects of sheet processing variables, 16: 21009(R) (AD-264815)
ALUMINUM–TITANIUM–ZIRCONIUM ALLOYS
creep properties, effects of sheet processing variables, 16: 21009(R) (AD-264815)
mechanical properties, effects of cooling rate, 16: 21016(R) (AD-266140)
ALUMINUM–TUNGSTEN–URANIUM ALLOYS
use as radiation shielding materials, 16: 21006(P)
ALUMINUM–URANIUM ALLOYS
dissolution and processing of irradiated, 16: 20534(R) (IDO-14574)
radiation effects, 16: 21839(R) (IDO-16760)
ALUMINUM–ZINC ALLOYS
properties evaluation for coating niobium, 16: 21031 (DC-60-8-25)
ALUMINUM–ZIRCONIUM ALLOYS
crystal structure of ZrAl, 16: 21051
AMERICIUM
crystal structure and properties, 16: 20305(R) (UCRL-10023)
separation from elements with atomic numbers 89 to 95 by paper chromatography, 16: 20340
AMERICIUM CHLORIDES
absorption spectrum in lanthanum chloride, 16: 20305(R) (UCRL-10023)
AMERICIUM ISOTOPES Am-241
gamma spectra, angular correlations, 16: 21446
AMERICIUM ISOTOPES Am-242
alpha decay, 16: 20305(R) (UCRL-10023)
decay scheme for 152-yr isomer, 16: 21518
AMINE COMPLEXES
with cobalt(III) bromides, recoil chemistry of bromine in, 16: 20480
AMINES
hydrolysis of inorganic salts in aqueous solutions, complex extraction by, 16: 20434
spectra of deuterated, stretching frequencies in infrared, 16: 20446
AMINO ACIDS
determination by radiochromatography, apparatus for scintillometry of effluent, 16: 20347
AMMINES
compounds with ruthenium phosphates, preparation and composition, 16: 20422
AMMONIUM CITRATES
properties as decontaminant for water cooled reactors, 16: 20984
AMMONIUM IRON(II) SULFATES
radiolysis of solution containing nitrous oxide, G values for, 16: 20514
AMMONIUM URANIUM FLUORIDES
production from uranyl nitrate by dry method, pilot plant for, 16: 20530
AMPLIFIERS
design for gamma-compensated ionization chambers, 16: 20690(P)
design of high-voltage transistorized preamplifier, 16: 20795
equipment for measuring the linearity and long-term stability of pulse amplifier gain, 16: 20783
AMYLASES
inhibition by aluminum and beryllium salts, 16: 20061
ANALYSIS
of biological materials for elements, 16: 20097
ANIMAL CELLS
mitotic index, inhibitory effect of irradiated culture medium on, 16: 20204
radiation effects on metabolism of Yoshida ascites hepatoma, 16: 20194
ANIMALS
vanadium uptake and distribution in *Ciona intestinalis*, 16: 20119
ANISOLE
deuterium exchange, acid-catalyzed, 16: 20306
ANP REACTORS
disconnects, design of remote quick, 16: 20561 (DC-59-9-154)
fission products, computer program for isotopic buildup, 16: 20935 (XDC-60-3-211)
ANTHRACENE
electron-induced triplet excitation, 16: 20467 (ASD-TDR-62-32(Pt.II))
ANTIBIOTICS
therapeutic effects of ointments, in radioinduced skin lesions, 16: 20[illegible]
ANTIBODIES
formation in irradiated rabbits, 16: 20275
radiation effects on formation in mice, 16: 20273
radiation effects on formation by spleen cells in mice, 16: 20274
radiation effects on formation in rabbits, 16: 20276
ANTIHYPERONS (Ξ^-)
discovery, 16: 21275
ANTIMONY
determination of trace amounts by neutron activation, 16: 20345
ANTIMONY ALLOYS
thermoelectric properties, 16: 21012(R) (AD-265328)
ANTIMONY ISOTOPES Sb-121
neutron reactions (n,2n), excitation functions for, 16: 21352 (NP-1160)
ANTIMONY ISOTOPES Sb-122
decay, polarization of electrons in beta, 16: 21614
half life of isomeric, 16: 21839(R) (IDO-16760)
ANTIMONY ISOTOPES Sb-123
half life, 16: 21405
ANTIPROTONS
annihilation reactions, three-meson (π) resonance at 785 Mev in, 16: 21620
interactions with protons, meson (K^0) production in, 16: 21317
APATITES
form of uranium in, 16: 20825
ARABINOSE
sorption by rat intestine, effects of thorium ions, 16: 20115
ARGENTINA
fall-out monitoring, 1961, 16: 20856 (A/AC.82/G/L.746)
ARGON
alpha ionization at 5.14 Mev, effects of other gases on, 16: 21136 (TID-15708)
diffusion in potassium halides, 16: 21047(T,R) (EURAEC-17)
diffusion in potassium halides, 16: 21049(T,R) (EURAEC-121)
proton scattering near 100 kev, ionization cross sections, 16: 21218
spectra, excited by alpha and electron impacts in pure, 16: 21147
ARGON ISOTOPES Ar-37
content in Ehole (Angola) meteorite, 16: 20842
electron capture (L/K) ratios, 16: 21408
ARGON ISOTOPES Ar-39
content in Ehole (Angola) meteorite, 16: 20842
ARGON ISOTOPES Ar-40
content in rocks from eastern Greenland, 16: 20845
proton inelastic scattering at low energies, reaction mechanisms for, 16: 21393
ARGON ISOTOPES Ar-41
decay, beta-gamma circular-polarization correlation and isospin conservation in, 16: 21616
distribution in NRX stack dilution tests, 16: 20858 (AECL-1518)
ARGON–NITROGEN SYSTEMS
electric discharge, constriction, volt-ampere characteristics, and volume recombination of the positive column, 16: 21179
ARGONNE LOW POWER RESEARCH REACTOR
development, 16: 21794(R) (ANL-6565)
ARGONNE NATIONAL LAB., LEMONT, ILL.
monitoring of environs, 1961, 16: 20907
ARMY REACTORS (SM-2)
materials development, 16: 20041(R) (BMI-1574(Del.))
ARSENIC
determination in hair, activation, 16: 20344
determination in nuclear steels, neutron activation, 16: 20330

determination of trace amounts by neutron activation, 16: 20345
metallurgical effects on electron and hole drift mobilities in selenium, 16: 21018 (AFOSR-1416)
ARSENIC ISOTOPES As-77
separation from irradiated germanium, carrier-free, 16: 20474(T) (CEA-tr-R-1476)
yield from neutron fission of uranium-235, 16: 21347 (AWRE-0-58/61)
ARSENITE IONS
complexes with thorium, effects of pH on, 16: 20384
reactions with sodium and thorium nitrates, effects of pH on, 16: 20384
ASBESTOS
reactions with sodium hydroxide and zirconyl chloride, 16: 20350(R) (AGC-0423-01-3)
ASPARTIC ACID
radiation effects in single crystals, electron spin resonance study, 16: 20496
ASTATINE ISOTOPES At-206
production in thorium (p,*xn*) reactions at 155 Mev, cross sections, 16: 21374
ASTATINE ISOTOPES At-207
production in thorium (p,*xn*) reactions at 155 Mev, cross sections, 16: 21374
ASTATINE ISOTOPES At-209
production in thorium (p,*xn*) reactions at 155 Mev, cross sections, 16: 21374
ASTATINE ISOTOPES At-210
production in thorium (p,*xn*) reactions at 155 Mev, cross sections, 16: 21374
ASTATINE ISOTOPES At-211
production in thorium (p,*xn*) reactions at 155 Mev, cross sections, 16: 21374
ASTROPHYSICS
origin of cosmic magnetic fields, 16: 21234
ATMOSPHERE
acoustic-gravity wave propagation in, model for, 16: 20837
analysis for cerium-144 at Westwood, New Jersey, July 1960 to June 1961, 16: 20816 (NYO-9531)
analysis for radon isotopes, 16: 20848
fall-out monitoring, Germany, 1961, 16: 20846
processes in, theoretical studies, 16: 21122 (AFCRL-1062-II)
radioactivity effects in humans, 16: 20229
ATOMIC ENERGY
accidents and legal remedies in England, 16: 20052
developments, review of chemists' contribution, 16: 20309
legal aspects, West German laws on radioactive pollution, 16: 21864
patent rights in the United States, Great Britain, France, and the German Republic, 16: 20050
research progress in Australia, 1960 and 1961, 16: 20044 (NP-11606)
ATOMIC ENERGY COMMISSION
byproduct licensees, 1961, 16: 20906
ATOMIC EXPLOSIONS
blast effects, minimization by installation hardening, 16: 20869 (NP-11653)
book: *The Effects of Nuclear Weapons*, 16: 20908
chemical uses, 16: 20537(R) (ORNL-TM-177)
seismic amplitudes, effects of depth or altitude, 16: 20823
ATOMIC MASSES
adoption of carbon-12 scale for, 16: 20307
ATOMIC PHYSICS
book: *Quantum Theory of Many-Particle Systems*, 16: 21223
electronic wave-function determination by Thomas-Fermi method, with self-interaction corrections, 16: 21212
random-phase-approximation instability, for strong attractions, 16: 21148
random-phase-approximation instability, for strong attractions and strong short-range repulsions, 16: 21149
transition matrix for scattering of free particles by systems of identical bound particles, 16: 21312
ATOMIC WEAPONS
tactical uses, 16: 20051
ATOMS
bound state properties, 16: 21122 (AFCRL-1062-II)
decay of bound muons from K-shell, 16: 21611
ionization of inner shells, 16: 21121 (AFCRL-1062-I)
reactions at 0.3 to 3.0 kev, energy distribution of induced electrons, 16: 21346 (ARL-185)
reactions with atoms and ions, 16: 21121 (AFCRL-1062-I)
AURORAL STORMS
analysis, for information on energies of solar origin, 16: 20231
AZO DYES
analytical use for spectrophotometric determination of thorium and uranium, 16: 20348

B

BACTERIA
radiation effects on cellulose-decomposition activity of rumen, 16: 20206
radiation effects on *B. cadaveris*, 16: 20142
radiosensitivity of *Clostridium botulinum*, 16: 20914
radiosensitivity of *E. freundii*, protective effects of fluoroacetate against, 16: 20144
radiosensitivity of *Streptococcus faecalis* to ultraviolet, effects of 6-azathymine, 16: 20151
BACTERIOPHAGES
desoxyribonucleic acid length in T2, 16: 20096
radioinduced inactivation, effects of cysteamine and cysteine on, 16: 20293
radioinduced inactivation, effects of cysteamine and glycerine on, 16: 20294
radiosensitivity effects of cysteamine during intracellular cycle, 16: 20292
BARIUM
alpha and carbon-12 reactions, gamma distributions from, 16: 21457
determination as trace in standard rocks G-1 and W-1, spectrographic, 16: 20831
BARIUM FLUORIDE–LITHIUM FLUORIDE–URANIUM FLUORIDE SYSTEMS
electric conductivity, 16: 20525(R) (MCW-1472)
BARIUM IONS
diffusion in bentonite clay-water pastes, self-, 16: 20425
BARIUM ISOTOPES Ba-140
separation from waste solutions by flocculation, 16: 21862
BARIUM SULFATES
effectiveness in treatment of strontium-90 ingestion in man, 16: 20077
effects on elimination of strontium-90, 16: 20077
BASES
radioinduced hydrogen evolution, effects of bromide ion, 16: 21130(R) (NP-11643)
BELGIUM
fall-out monitoring at Mol, 1960, 16: 20812(R) (A/AC.82/G/L.711)
fall-out monitoring, Mol, 1960, 16: 20813(R) (A/AC.82/G/L.721)
BENTONITES
adsorptive properties of Radgendorf, for cerium ions and ruthenium and zirconium complexes, 16: 21865
diffusion of cations in, self-, 16: 20425
BENZANTHRACENE
electron-induced triplet excitation, 16: 20467 (ASD-TDR-62-32(Pt.II))
BENZENE
deuterium exchange, acid-catalyzed, 16: 20306
radiolysis by 0.60 to 3.88-Mev protons at 20 to 25°C, 16: 20517
radiolysis effects on hexane, 16: 20512
solubility in sulfuric acid, effects of isotopic mass of hydrogen, 16: 20382
BENZENE–CARBON TETRACHLORIDE SYSTEMS
radioinduced energy transfer and free radical production in, 16: 20510
BENZIDINE, H,N,N',N'-TETRAMETHYL-
electron paramagnetic resonance spectra, effects of deuteron substitution, 16: 20419
BENZOPHENONES
spectra of free radical anion, effects of lithium bromide, 16: 20455
BERYLLIUM
bibliography, 16: 20956 (NP-10640(Suppl.II))
determination as trace in standard rocks G-1 and W-1, spectrographic, 16: 20831
deuteron scattering at 13 Mev, angular distributions from elastic, 16: 21566

diffusion and solubility of iron in, 16: 21054
economic aspects of nuclear uses, production, processing, and resources, 16: 20962
extraction from ores, use of tracer techniques for analyses, 16: 20950 (BM-RI-5980)
forging, development of technique using hot carbon steel die components, 16: 20991(R) (ASD-TR-7-647(VI))
mechanical properties and preparation of high-purity, 16: 20958(R) (NP-11702)
metallurgical effects on friction and wear of Hastelloy-X and Inconel-X, 16: 21029 (DC-60-1-146)
neutron cross sections, 16: 21334 (DC-60-12-98)
neutron reactions (n, 2n), effects in reactors, 16: 21728 (XDC-60-1-211)
radiographic analysis, methods for, 16: 20809
tensile properties in aluminum–silver matrix, 16: 21019(R) (ARF-2212-5)

BERYLLIUM ALLOYS
phase transformations, effects of ultra-rapid quenching, 16: 21011(R) (AD-264988)

BERYLLIUM COMPLEXES
with 3-cyanopentane-2,4-dione, stretching frequency of cyano group in, 16: 20421

BERYLLIUM COMPOUNDS
bibliography, 16: 20956 (NP-10640(Suppl. II))
effects on mammalian amylase activity, 16: 20061

BERYLLIUM CRYSTALS
deformation at high temperature, determination by Laue photographs, 16: 21045(T) (AEC-tr-5138)
deformation of zone-refined, 16: 20954(R) (NMI-2104)
neutron reflectivity, 16: 20637 (JAERI-1030(Suppl.))
preparation of zone-refined for deformation studies, 16: 20955(R) (NMI-2105)
tensile deformation of oriented single, at 25 to 600°C, 16: 21062

BERYLLIUM FLUORIDE–LITHIUM FLUORIDE–SODIUM FLUORIDE SYSTEMS
corrosive effects of liquid, on nickel-base alloys, 16: 20974 (BMI-X-198)

BERYLLIUM ISOTOPES Be-7
energy-level lifetimes, 16: 21441
neutron reactions (n,α) at thermal energies, alpha properties from, 16: 21401

BERYLLIUM ISOTOPES Be-8
energy levels and dipole gamma spectra, 16: 21452

BERYLLIUM ISOTOPES Be-9
alpha reactions (α,n) at 5.35 Mev, angular correlations in, 16: 21601
deuteron reactions at 1 and 1.3 Mev, cross sections for capture, 16: 21638
deuteron reactions (d,pγ), distorted-wave analysis, 16: 21553
deuteron reactions (d,n) at 2 to 4 Mev, angular distributions from, 16: 21588
photodisintegration, review of experimental and theoretical studies, 16: 21585
photoneutron emission from, polarization in, 16: 21410

BERYLLIUM MODERATED REACTORS
multiplication constants for bare, 16: 21728 (XDC-60-1-211)

BERYLLIUM OXIDE–CALCIUM OXIDE SYSTEMS
crystal structure and phase studies, 16: 20381

BERYLLIUM OXIDE COMPACTS
thermal expansion at −200 to 0°C, 16: 21057

BERYLLIUM OXIDE–STRONTIUM OXIDE SYSTEMS
crystal structure and phase studies, 16: 20381

BERYLLIUM OXIDE–YTTRIUM OXIDE SYSTEMS
crystal structure and phase studies, 16: 20381

BERYLLIUM SULFATES
effects on mammalian amylase activity, 16: 20061

BESSEL FUNCTIONS
modeling, non-linear, 16: 21661 (AFCRL-746)

BETA DECAY
corrections for mesons and other effects in, 16: 21607
Fermi transition isotopic selection rule and vector interactions in, 16: 21618
matrix elements systematics, 16: 21608

BETA PARTICLES
carcinogenic effects on bronchial epithelium in rat lung, 16: 20147
carcinogenic effects on alveolar epithelium in rat lung, 16: 20148
detection and measurement, Cherenkov detector for, 16: 20712
genetic effects on cell nuclei from incorporation of tritium-labeled thymidine in cell, 16: 20222
polarization in decay of radioisotopes, 16: 21614

BETA SOURCES
activity measurements with spherical ionization chamber, method for, 16: 20672

BETA SPECTROMETERS
design for detection of low energy electrons, 16: 20645 (TID-15742)

BETA SPECTROSCOPY
delayed-coincidence methods using τ-f deflection, 16: 21438

BETATRONS
electron capture in stable orbits, 16: 21651 (SIT-P53)

BETTIS ATOMIC POWER LABORATORY, PITTSBURGH
monitoring of environs, 1961, 16: 20906

BIBLIOGRAPHIES
on all-metal sandwiches, 16: 20957 (NP-11677)
on beryllium and beryllium compounds, 16: 20956 (NP-10640(Suppl. II))
on effects of fall-out and natural radiation on human organism, 16: 20229
on ion exchange advances, 16: 20390
on magnetohydrodynamics and plasma physics, 16: 21660 (AD-271170)
on pathological changes in lungs during radiation sickness, 16: 20228
on perturbation effects on electromagnetic cavity resonators, 16: 21652 (TID-15417)
on pressure welding, 1944 to 1961, 16: 20995 (NP-11776)
on radiation damage in ceramic materials, 16: 21085
on radiation effects on virus infection and immunity, 16: 20227
on radiation protection, 16: 20859 (AERE-READING-LIST-8)
on radioactivity procedures, clinical and biological, 16: 20904
on space environment, 16: 21845 (AD-266034)
on teratogenic effects of radiation, 16: 20210
on thermoluminescence, 16: 21133 (TID-3911)

BIOCHEMISTRY
book: *Elements of Radiation Biochemistry*, 16: 20120

BIOLOGICAL MATERIALS
analysis for elements, roentgenofluorimetric, 16: 20097
analysis of seaweed for ruthenium-106, 16: 20322 (PG-Report-122)
pathological effects on secondary cosmic rays, 16: 20240
radiation effects, review of secondary, 16: 20291

BIPHENYL
electron-induced triplet excitation, 16: 20467 (ASD-TDR-62-32(Pt. II))
separation of chlorinated, from water by settling, 16: 20540 (UCRL-10048)

BISMUTH
determination in rare earth oxides, spectrographic method for, 16: 20337

BISMUTH (LIQUID)
density, 16: 21041(R) (TID-15663)

BISMUTH FLUORIDES
meson (μ⁻) capture probabilities, 16: 21174

BISMUTH ISOTOPES Bi-203
gamma scattering, properties of giant resonance, 16: 21456

BISMUTH ISOTOPES Bi-206
electron emission, delayed-coincidence spectra, 16: 21439

BISMUTH ISOTOPES Bi-207
gamma spectra, 16: 20628 (ANL-6499)

BISMUTH ISOTOPES Bi-209
energy levels and E3 and E4 gamma spectra, 16: 21450

BISMUTH ISOTOPES Bi-210
beta emission, vector current conservation in, 16: 21412
decay, matrix elements in beta, 16: 21608
decay, spectra of beta, 16: 21612

BISMUTH ISOTOPES Bi-211
alpha decay, 16: 21369

BISMUTH ISOTOPES Bi-212
electron emission, delayed-coincidence spectra, 16: 21438

BISMUTH OXIDES
radiation effects on films, on glass, 16: 21108

BISMUTH–URANIUM ALLOYS
phase studies, effects of copper and palladium on, 16: 21071

BISMUTH–URANIUM ALLOYS (LIQUID)

fission product release at 800°C, 16: 20042(R) (BNL-696)
BLOOD
coagulation, x-radiation effects on retraction acceleration in, 16: 20205
effects of radiotherapy of uterine carcinoma, 16: 20264
uptake of iron-59 in irradiated pregnant mice, 16: 20190
BLOOD CELLS
radiation effects on granulocyte peroxydases in normal and leukemic blood, 16: 20161
BLOOD CIRCULATION
measurement of foot peripheral, with iodine-131-labeled albumin, 16: 20053
BLOOD PICTURE
in Nagasaki bomb survivors, 16: 20248
in Nagasaki bomb survivors, 16: 20249
radiation effects, 16: 20156(T)
BLOOD PLASMA
radiation effects on proteins in, prolonged small-dose, 16: 20188
BLOOD PLATELETS
effects of irradiation and splenectomy, in mice, 16: 20277
effects of whole-body irradiation on ultraviolet-thrombopoietic factor in mice, 16: 20290
BLOOD SERUM
calcium and strontium binding by proteins, 16: 20111
BLOOD VESSELS
radiation sickness effects on pulmonary chronic, 16: 20189
BOILERS
design and operation for nuclear power plants, 16: 20622(P)
BOILING
bubble diameter and frequency relations in nucleate pool, 16: 20601
hydrodynamic model for stagnation flow in nucleate pool, 16: 20605
in liquids, review, 16: 20313
nucleation from liquid–liquid interface, 16: 20617
nucleation from mercury and metal surfaces, 16: 20618
BOILING REACTOR EXPERIMENTS
development, 16: 21794(R) (ANL-6565)
BOILING REACTORS
burnout heat flux sustained by boiling water, effects of ultrasonic vibrations, 16: 20591(R) (ATL-A-113)
control system with filler members for startup of water-moderated, 16: 21787(P)
coolant flow, balancing device evaluation, 16: 21820(R) (TID-15436)
coolant flow control, design for fuel assemblies, 16: 21727 (TID-15473)
design and characteristics of closed-cycle water, 16: 21786(P)
design of heavy water, 16: 21838(P)
design with emergency cooling system for shutdown, 16: 21836(P)
fuel containing thorium, feasibility, 16: 21736
fuel element rupture, evaluation of damage and decontamination procedures, 16: 20303(R) (ANL-6477(p.224-30))
heat transfer and pressure drop calculations, computer code, 16: 20592(R) (EURAEC-264)
heat transfer, development of improved, 16: 21811(R) (EURAEC-35)
heat transfer in, effects of single vortex, 16: 20596(T,R) (EURAEC-33)
BONDING
development of cold and gas-pressure processes, 16: 20041(R) (BMI-1574(Del.))
BONE MARROW
adaptation to incompatible mouse strain with lethal irradiation, 16: 20282
effects of lethal irradiation in rats, protective effects of desoxyribonucleic acid, 16: 20283
granulocytic precursors in, effects of irradiation of spleen on, 16: 20262
injections, effectiveness in treatment of radiation injuries in man, 16: 20242
protective effects against radiation in mice, 16: 20160
radiation dose received by, in cardiac catheterization, 16: 20888
radiation effects in pregnant mice, 16: 20190
radiosensitivity, 16: 20070
radiosensitivity, 16: 20156(T)
BONES
metabolism of calcium and strontium, effects of thyroxine, 16: 20064
metabolism of calcium and strontium in rats, 16: 20118
strontium-90 content of human, 16: 20107
thorium distribution in, following inhalation of thorium chloride, 16: 20876 (UR-605)
BORIC ACID
sorption by aluminum oxides, 16: 21839(R) (IDO-16760)
BORON
determination as trace in standard rocks G-1 and W-1, spectrographic, 16: 20831
determination by activation with charged particles, 16: 20321 (NP-11608)
determination in rare earth oxides, spectrographic method for, 16: 20327
metallurgical effects on friction and wear of Hastelloy-X and Inconel-X, 16: 21029 (DC-60-1-146)
BORON–CHROMIUM–IRON–NICKEL SYSTEMS
nuclear properties, 16: 21839(R) (IDO-16760)
BORON COMPOUNDS
properties for use in light-weight neutron shields, 16: 21690(R) (AD-267561L)
BORON FILMS
detection on silicon surfaces, activation, 16: 20346
BORON FLUORIDE–METHYL ETHER SYSTEMS
spectra, isotope effects on infrared, 16: 20445
BORON FLUORIDES
heat of formation, 16: 20299(R) (ANL-6477(p.155-67))
BORON–HAFNIUM SYSTEMS
corrosion rates at 1000°C, 16: 20971(R) (AD-266150)
BORON HYDRIDES
isotope exchange with deuterium chloride, 16: 20397
BORON–IRON SYSTEMS
solvent properties for nitrogen, 16: 21073
BORON ISOTOPES B-10
deuteron reactions (d,p) at 12.5 to 21.5 Mev, energy dependence of angular distribution in, 16: 21559
deuteron reactions (d,p) at 10.1 Mev, angular distributions from, 16: 21593
energy levels and dipole gamma spectra, 16: 21452
energy levels, lifetimes, 16: 21440
fluorine isotope reactions (F^{19},F^{18}) up to 43 Mev, 16: 21428
helium nucleus reactions (helium-3, py) at 4.5 Mev, angular correlations in, 16: 21568
nitrogen-14 nucleus reactions at 28 Mev, nucleon transfer in, 16: 21575
triton reactions (t,d) at 0.9 to 2.0 Mev, cross sections, 16: 21567
BORON ISOTOPES B-11
deuteron reactions (d,n) at 2.65 and 5.35 Mev, distorted-wave effects in, 16: 21587
deuteron reactions (d,n), shell model analysis, 16: 21353 (NP-11681)
energy levels and gamma spectra, 16: 21427
nitrogen-14 nucleus reactions at 28 Mev, nucleon transfer in, 16: 21575
BORON NITRIDES
formation by nitrogen solubility in boron–iron systems, 16: 21073
BORON STEEL
fabrication, development of techniques for, 16: 21034 (HW-SA-2583)
properties evaluation for use as reactor thermal shielding, 16: 21034 (HW-SA-2583)
BOROSILICATE GLASS
radioinduced defects, electron spin resonance studies of annealing effects, 16: 20476
BOSONS
magnetic and thermodynamic properties of charged gases at 0°K, 16: 21216
production and decay of heavy, 16: 21291
BOUNDARY LAYER
transition of laminar flow on flat plate, equipment and measurements of, 16: 20614
BRAIN
radiation effects on tritium incorporation in, 16: 20221
radiotherapy of tumor, frontal bone sarcoma induction by, 16: 20171
BREEDER REACTORS
description of fast, 16: 21732
design feasibility of fast uranium-233–thorium, 16: 21723 (NDA-2134-3)
BREMSSTRAHLUNG
energy dissipation by, spatial distribution, 16: 21135 (TID-15706)
scattering, use for measurement of mass per unit area, 16: 21179

BROMIDES
radiation effects, measurement of amount and composition of radiation products, 16: 20466 (AERE-R-3409)
BROMINE
content in human serum and muscles, 16: 20098
BROMINE IONS (RECOIL)
reactions with bisethylenediamine and pentammine cobalt(III) bromides, 16: 20480
BROMINE ISOTOPES Br-79
neutron reactions (n,2n), excitation functions for, 16: 21352 (NP-11667)
BROMINE ISOTOPES Br-82
yield from neutron fission of uranium-235, 16: 21347 (AWRE-0-58/61)
BROMINE ISOTOPES Br-83
yield from neutron fission of uranium-235, 16: 21347 (AWRE-0-58/61)
BROMINE ISOTOPES Br-84
yield from neutron fission of uranium-235, 16: 21347 (AWRE-0-58/61)
BROOKHAVEN ALTERNATING-GRADIENT SYNCHROTRON
neutral particles in 30° proton beam at 30 Bev, 16: 21650 (NP-11624)
BROOKHAVEN REACTOR
moderator, radiation effects, 16: 20042(R) (BNL-696)
BUBBLE CHAMBERS
design and performance as neutron spectrometers, 16: 20683
BUBBLES
interactions with shock waves, configurations from, 16: 20608
BUILDING MATERIALS
radioactivity measurements on building block, 16: 20871 (PAN-269/I-A)
BURNS
effects of whole-body irradiation on healing, in rats, 16: 20289
of hands from radiation, treatment, 16: 20136
2,3-BUTANEDIONE
radiolysis products, 16: 20305(R) (UCRL-10023)
BUTYL PHOSPHATE–KEROSENE–NITRIC ACID SYSTEMS
distribution of uranyl phosphate in, 16: 20535(R) (IDO-14583)
BUTYL PHOSPHATES
separation from aqueous streams, mixer settler design for, 16: 20534(R) (IDO-14574)
solvent properties for tetravalent plutonium, 16: 20369(T) (AEC-tr-4457 (p.161-6))
solvent properties for uranyl nitrates, 16: 20542(T) (TRG-Inf-Ser-42)

C

CABLES
leak detection using radon, 16: 20910(T) (CEA-tr-A-1052)
CADMIUM
hyperfine structure, 16: 21129(R) (NP-11640)
separation from indium-111 produced in proton irradiation with cyclotron, 16: 20551
CADMIUM ISOTOPES Cd-110
energy levels, 16: 21380
energy levels, 16: 21381
CADMIUM ISOTOPES Cd-111
gamma spectra, angular correlations, 16: 21446
CADMIUM ISOTOPES Cd-112
oxygen ion reactions, Coulomb excitation by, 16: 21517
CADMIUM ISOTOPES Cd-113
half life, 16: 21405
CADMIUM ISOTOPES Cd-114
oxygen ion reactions, Coulomb excitation by, 16: 21517
CADMIUM OXIDES
radiation effects on films, on glass, 16: 21108
CADMIUM SELENIDES
imperfection ionization energies and photoelectronic properties, 16: 21222
CADMIUM SULFIDE CRYSTALS
performance as gamma radiation detectors, 16: 20663
CADMIUM SULFIDES
imperfection ionization energies and photoelectronic properties, 16: 21222
CADMIUM TELLURIDES
imperfection ionization energies and photoelectronic properties, 16: 21222
CADMIUM–URANIUM ALLOYS
thermodynamic properties, 16: 21070
CADMIUM ZINC SULFIDES
electroluminescence, enhancement and quenching, 16: 20470(R) (NP-11604)
CALCIUM
binding by serum proteins, 16: 20111
determination in chicken by neutron activation, 16: 20337
determination in rare earth oxides, spectrographic method for, 16: 20327
ion exchange equilibria with cerium on humic acid, 16: 20461
metabolism in bone, tracer study, 16: 20064
scattering by light nuclei at 13 Mev, angular distributions from elastic, 16: 21566
separation from cerium by ion exchange on chernozem, 16: 20460
uptake by bones in rats, 16: 20118
CALCIUM CHLORIDES (LIQUID)
corrosive effects on alloys and metals in chemical plants, 16: 20983
CALCIUM FLUORIDE–THORIUM FLUORIDE–ZINC FLUORIDE SYSTEMS
decomposition voltage of zinc fluoride in, at 1100°C, 16: 20966
CALCIUM IONS
diffusion in bentonite clay-water pastes, self-, 16: 20425
exchange on natural and synthetic exchangers, 16: 20356 (JÜL-32-RC)
CALCIUM ISOTOPES
gamma scattering, properties of giant resonance, 16: 21456
CALCIUM ISOTOPES Ca-40
dipole resonance in, giant, 16: 21511
energy levels, lifetimes, 16: 21440
meson (μ) capture rates, 16: 21399
proton scattering at 150 Mev, excited states from, 16: 21500
CALCIUM ISOTOPES Ca-41
deuteron reactions (d,p) at 10.8 Mev, polarization in, 16: 21581
CALCIUM ISOTOPES Ca-44
meson (μ) capture rates, 16: 21399
CALCIUM ISOTOPES Ca-45
determination by liquid scintillation counting, 16: 20334
CALCIUM OXIDE–MAGNESIUM OXIDE–SILICON OXIDE–ZIRCONIUM OXIDE SYSTEMS
properties for use as refractory material, 16: 21067
CALCIUM URANATES
formation in aqueous media, 16: 20385
CALIFORNIUM
spectra, absorption, emission, and self-luminescent, 16: 20305(R) (UCRL-10023)
CALIFORNIUM ISOTOPES Cf-249
alpha decay, preferential polar emission, 16: 20305(R) (UCRL-10023)
CALIFORNIUM ISOTOPES Cf-252
fission, probability of emission of long-range particles, 16: 21420
CALORIMETERS
design and performance for measuring electron beam power, 16: 20651
CALUTRONS
sparking, irradiation of small sphere gaps for voltage measurement, 16: 20571
CAPRYLIC ACID
etching effects on lithium fluoride crystals, adsorption-locking and Rebinder effect in, 16: 20437
CARBAMIC ACID, ETHYL ESTER
lymphoma induced by, in mouse thymus, 16: 20074
CARBON
chlorination in rutile mixtures, radiation effects, 16: 20468 (BM-RI-5994)
determination by activation with charged particles, 16: 20321 (NP-11608)
deuteron scattering at 125 to 422 Mev, cross sections and polarization, 16: 21467
deuteron scattering at 13 Mev, angular distributions from elastic, 16: 21566
deuteron scattering at 1 to 1.46 Mev, elastic, 16: 21629
elastic and thermal properties, 16: 21038(R) (NP-11665)
electron elastic scattering cross sections at 0 to 15 ev, 16: 21202
electron scattering at 41.4 Mev, cross sections, 16: 21640
electron scattering, shell structure determination by, 16: 21471
proton reactions at 154 Mev, energy spectra of deuterons, protons, and

tritons from, 16: 21488
proton scattering, determination of shape of imaginary part of optical model potential in, 16: 21540
CARBON DIOXIDE–CARBON MONOXIDE SYSTEMS
oxidation effects on cobalt and iron at 700 to 1200°C, 16: 20360 (NYO-10289)
CARBON DIOXIDES
corrosive effects on alloy steels at 0 to 15 atm and 450 to 500°C, 16: 20986
determination of carbon-14-labeled respiratory, apparatus, 16: 20326
effects on radiolytic formation of hydrogen from silane, 16: 20478
radiolysis of aqueous solutions, production of organic compounds in, 16: 20492
use as filling gas for counter, effects of purification, 16: 20668
CARBON ION BEAMS (C-12)
reactions on medium nuclei, gamma distributions from, 16: 21457
CARBON IONS
electron photodetachment cross sections, 16: 21202
CARBON–IRIDIUM–SILICON SYSTEMS
stability of solid phases, 16: 20394
CARBON–IRON SYSTEMS
strengthening two-phase, by cold working, 16: 21069
CARBON ISOTOPES
separation by bicarbonate method, optimum conditions for, 16: 20925(T) (CEA-tr-R-1495)
CARBON ISOTOPES C-11
production by photodisintegration and electrodisintegration of oxygen-15, excitation curves, 16: 21377
CARBON ISOTOPES C-12
alpha reactions (α, 2α), alpha clustering behavior, 16: 20305(R) (UCRL-10023)
alpha reactions (α,p), proton angular distributions, 16: 21417
decay of excited, by three alpha particle break-up, 16: 21637
deuteron reactions at 1 and 1.3 Mev, cross sections for capture, 16: 21638
deuteron reactions (d,n) at 4 Mev, angular distributions and excitation curves from, 16: 21589
deuteron reactions (d,p) at 15 Mev, angular dependence of proton polarization in, 16: 21597
deuteron reactions (d,p) at 6 Mev, effects of proton spin-orbit distortion on angular distributions and polarization, 16: 21599
energy-level lifetimes, 16: 21441
energy levels and dipole gamma spectra, 16: 21452
excited states in, computation by Green's function formalism, 16: 21520
El resonance in, calculations of ground-state correlation effects, 16: 21524
helium isotope reactions (He^3, p), 16: 20305(R) (UCRL-10023)
helium nucleus reactions (helium-3, n) at 1.8 to 5.3 Mev, angular distributions, cross sections, and yields, 16: 21551
neutron and proton reactions (n,pn), (p,pn), and (p,2p) at 120 to 150 Mev, gamma spectra of residual nuclei, 16: 21466
neutron inelastic scattering, time-of-flight spectrometry, 16: 21378
proton reactions (p,pn), recoil behavior, 16: 20305(R) (UCRL-10023)
proton reactions (p,p'γ) at 150 Mev, excitation of 15.1 Mev level in, 16: 21481
proton reactions (p,2p) at 155 Mev, momentum distribution of p and n protons in nucleus from, 16: 21489
proton scattering at 150 Mev, gamma and proton angular correlation in, 16: 21468
reactions (carbon-12,α) with carbon-12 at 12.5 Mev, cross sections, 16: 21603
reactions with carbon-12, optical model for potential in elastic, 16: 21368
scattering elastic on iron, nickel, and silver, 16: 20305(R) (UCRL-10023)
triton reactions (t,α) at 1 to 2 Mev, cross sections, 16: 21569
CARBON ISOTOPES C-13
deuteron reactions (d,p) at 10.8 Mev, polarization in, 16: 21581
deuteron reactions (d,α) at 3.26 and 3.45 Mev, angular distributions and double pick-up of inequivalent nucleons in, 16: 21577
effects on dehydration of formic acid by concentrated sulfuric acid, 16: 20398
helium nucleus reactions (helium-3,α) at 1.6 to 3.4 Mev, angular distributions and yields from, 16: 21595
helium nucleus reactions (helium-3, $\alpha\gamma$) at 4.50 Mev, angular correlations in, 16: 21571
neutron inelastic scattering, time-of-flight spectrometry, 16: 21378
photodisintegration, review of experimental and theoretical studies, 16: 21585
CARBON ISOTOPES C-14
content in iron and stone meteorites, age estimation from, 16: 20828
determination in compounds or mixtures, development of method for, 16: 20335
determination in respiratory carbon dioxide, apparatus, 16: 20326
helium nucleus reactions (helium-3,α) at 1.6 to 3.4 Mev, angular distributions and yields from, 16: 21595
labeling organic compounds with, by hot synthesis, 16: 20473(T) (AEC-tr-5082)
plant contamination with respect to geography, species, and time, 16: 20079
CARBON MONOXIDES
proton scattering near 100 kev, ionization cross sections, 16: 21218
CARBON–OSMIUM–SILICON SYSTEMS
stability of solid phases, 16: 20394
CARBON–OXYGEN–URANIUM SYSTEMS
phase studies, 16: 21050(T) (NP-tr-901)
CARBON–PALLADIUM–SILICON SYSTEMS
stability of solid phases, 16: 20394
CARBON–PLATINUM–SILICON SYSTEMS
stability of solid phases, 16: 20394
CARBON–RHENIUM–SILICON SYSTEMS
stability of solid phases, 16: 20394
CARBON–RHODIUM–SILICON SYSTEMS
stability of solid phases, 16: 20394
CARBON–RUTHENIUM–SILICON SYSTEMS
stability of solid phases, 16: 20394
CARBON STEEL
contamination by radionuclides in water-cooled reactors, 16: 21717 (DP-682)
corrosion by decontaminating solutions, 16: 20984
corrosion by high-temperature water, 16: 20976 (BW-3871)
radiation effects on atmospheric corrosion, 16: 21098
CARBON SULFIDES
boiling, hydrodynamic model for nucleate pool, 16: 20605
CARBON TETRACHLORIDE
boiling, hydrodynamic model for nucleate pool, 16: 20605
quenching effects on liquid scintillators, 16: 21158
CARBON–TUNGSTEN SYSTEMS
phase studies, 16: 21022 (ASD-TDR-62-25(Pt.I))
CARBONATES
radiation effects, measurement of amount and composition of radiation products, 16: 20466 (AERE-R-3409)
spectra, lattice frequencies and rotational barriers in infrared, 16: 20416
CARBONIC ACIDS
radiolysis with ultraviolet light, 16: 20519
CARCINOMAS
of lungs, incidence in Hiroshima survivors, 16: 20266
radioinduced in alveolar epithelium in rat lung, 16: 20148
radioinduced in bronchial epithelium in rat lung, 16: 20147
radiotherapy, effects on serum beta-glucuronidase activity, 16: 20258
radiotherapy of cervical, response, 16: 20057
radiotherapy of cervical, thyroid iodine levels after, 16: 20102
radiotherapy of cervical, resistance, 16: 20174
radiotherapy of ovarian, with gold-198, 16: 20141
radiotherapy of uterine cervix, effects on endometrium, 16: 20158
CAROLINAS-VIRGINIA TUBE REACTOR
critical experiments, test facility design, 16: 21716 (CVNA-114)
development, 16: 21825(R) (WCAP-4121)
valve performance for flow measurement and sampling in, 16: 20631 (CVNA-140)
CATALASES
effects on formate radio-oxidation, 16: 20485
CATALYSTS
chlorination in rutile mixtures, radiation effects, 16: 20468 (BM-RI-

5994)
evaluation for labeling hydrocarbons by exchange with water, 16: 20490
CATARACTS
development in lens of frog and mice eyes from wounds after x irradiation, 16: 20200
provocation by traumatization of irradiated eye lens, 16: 20165
radioinduced in Nagasaki bomb survivors, 16: 20133
CATION EXCHANGE MATERIALS
performance of sulfonated polystyrene for rare earths, 16: 20371(T) (AEC-tr-4457(p.187-9))
preparation of phosphorylated cellulose for adsorption of thorium from acid aqueous solutions, 16: 20311(P)
solvent properties of di(2-ethylhexyl) orthophosphoric acid for rare earths, 16: 20546
CATTLE
iodine-131 content of thyroids, Egypt, 1956 to 1957, 16: 20125
CAVES
cleaning methods, 16: 20896
design and construction of lead-shielded, 16: 20897
gamma flux distribution and leakage in Osaka, 16: 20881
shielding glass window, radiation damage, 16: 21097
CAVITY RESONATORS
perturbation effects, bibliography, 16: 21652 (TID-15417)
CELLULOSE
criticality of uranium-235-impregnated sheets, 16: 21258
preparation of phosphorylated, for adsorption of thorium from acid aqueous solutions, 16: 20311(P)
solvent properties of di(2-ethylhexyl) orthophosphoric acid-treated, for rare earths, 16: 20546
CELLULOSES
radioinduced decomposition in bovine rumen, 16: 20206
CERAMIC MATERIALS
book: *Progress in Ceramic Science*, 16: 21084
brittle behavior, 16: 21020 (ARF-8203-18)
machining studies, 16: 20990(R) (ASD-TR-7-532a(VI))
radiation damage in, 16: 21085
research progress under U. S. Army auspices, 1961, 16: 20043(R) (NP-11537)
surface preparation for microscopic examination in reflected light, 16: 21052
CERIUM
ion exchange equilibria with calcium on humic acid, 16: 20461
ion exchange on Radgendrof clay, 16: 21865
separation from calcium and sodium by ion exchange on chernozem, 16: 20460
CERIUM IONS
diffusion in bentonite clay-water pastes, self-, 16: 20425
spectra in crystalline salts, line widths of emission, 16: 21205
CERIUM ISOTOPES Ce-141
decay, matrix elements in beta, 16: 21608
decay, matrix elements and nuclear potentials in forbidden beta, 16: 21613
internal conversion coefficients of K shell, development of gamma scintillation spectrometry for determination, 16: 21134 (TID-15639)
sorption by stainless steel in boiling-water reactor, 16: 20303(R) (ANL-6477(p.224-30))
CERIUM ISOTOPES Ce-144
decay scheme, 16: 20667
determination in ground-level air and precipitation at Westwood, New Jersey, July 1960 to June 1961, 16: 20816 (NYO-9531)
determination in shore sand and sea silt, gamma-spectrometric, 16: 20323 (PG-Report-312)
gamma spectra, 16: 20628 (ANL-6499)
separation from waste solutions by flocculation, 16: 21862
CERIUM NITRATES
stability, determination by solvent extraction with TBP, 16: 20370(T) (AEC-tr-4457(p.167-82))
CERIUM OXIDES
analysis for impurities, spectrographic method for, 16: 20327
phase transitions in, high-temperature x-ray diffraction studies, 16: 20363(T) (NP-tr-893)
thermoelectric properties, effects of doping, 16: 21014(R) (AD-266097)
CERIUM SILICIDES
heats of formation, 16: 20394
CERIUM SULFATES
radiolysis of solution containing nitrous oxide, G values for, 16: 20514
CERIUM SULFIDES
preparation and doping, 16: 21014(R) (AD-266097)
preparation of sesqui, 16: 21013(R) (AD-266094)
CESIUM
absorption and uptake by Saclay soil, partition coefficients, 16: 20826
diffusion on tungsten, surface, 16: 21053
fusion curve and polymorphic transitions at high pressures, 16: 21191
ion exchange equilibria in systems with hydrogen and sodium, 16: 20457
ion exchange equilibria with hydrogen and sodium, rate of movement in chromatographic, 16: 20458
preparation by magnesium reduction of cesium fluoride, 16: 20374(T) (AEC-tr-4457(p.294-8))
separation from potassium and rubidium using the heterotrihalides, 16: 20389
CESIUM BORATES
analytical use of tetraphenyl-, in measuring uranium burnup, 16: 20317 (HW-72199)
CESIUM BROMIDES
scintillation properties at low temperatures, 16: 20707
CESIUM CHLORIDES
thermodynamic properties, 16: 20042(R) (BNL-696)
CESIUM FLUORIDES
reduction by magnesium at high-temperatures, 16: 20374(T) (AEC-tr-4457(p.294-8))
CESIUM IODIDES
neutron reactions (n,α) and (n,p) at 12.1 to 21.5 Mev, energy spectra and cross sections from, 16: 21552
scintillation of thallium-activated, induced by alpha particles and fission fragments, 16: 20669
scintillation properties at low temperatures, 16: 20707
CESIUM IONS
diffusion in bentonite clay-water pastes, self-, 16: 20425
exchange on natural and synthetic exchangers, 16: 20356 (JÜL-32-RC)
CESIUM ISOTOPES Cs-133
proton reactions (p,pn) at 20 to 155 Mev, excitation functions for, 16: 21484
CESIUM ISOTOPES Cs-134
decay, beta-gamma circular-polarization correlation and isospin conservation in, 16: 21616
deposition in hen's eggs, 16: 20109
CESIUM ISOTOPES Cs-137
content in hay in Germany, 1953 to 1961, 16: 20128
content in human diet in Argentina, 16: 20856 (A/AC.82/G/L.746)
content in sea water from Osaka Bay, Japan, 16: 20123
determination in shore sand and sea silt, gamma-spectrometric, 16: 20323 (PG-Report-312)
dosimetry in sheep, use of whole-body dose as indicator of gonad dose, 16: 20105
internal conversion coefficients of K shell, development of gamma scintillation spectrometry for determination, 16: 21134 (TID-15639)
monitoring environmental, Mol, 1960, 16: 20813(R) (A/AC.82/G/L.721)
monitoring environmental, Mol, 1960, 16: 20812(R) (A/AC.82/G/L.711)
separation from waste solutions by flocculation, 16: 21862
sorption by stainless steel in boiling-water reactor, 16: 20303(R) (ANL-6477(p.224-30))
CESIUM MANGANESE FLUORIDES
crystal structure, 16: 20305(R) (UCRL-10023)
CHAIN REACTIONS
stability conditions for, 16: 21259
CHARGED PARTICLE BEAMS
images and profiles, development of image intensifier-scintillator for determination, 16: 20642 (NP-11663)
polarization, 16: 21262 (CERN-62-8)
research programs at NRL, 16: 21130(R) (NP-11643)
CHARGED PARTICLES
charge-transfer approximations, 16: 21273
cyclotron resonance properties of bound and free, 16: 21222
detection and measurement by scintillation counters, linear method of

discrimination, 16: 20784
detection and measurement, electronic methods for pulse shape discrimination, 16: 20785
detection and measurement by scintillation counters, pulse discrimination method, 16: 20786
detection, flash-tube array for, 16: 20680
detection using flash tubes, computer technique for, 16: 20679
magnetic and thermodynamic properties of gases of, at 0°K, 16: 21216
motion, calculation by average density method using a digital computer, 16: 21157
motion in electromagnetic field, equations for, 16: 21672
properties in ionosphere, temperature measurements from, 16: 21227
track grain densities in emulsion, 16: 20677

CHELATES
tumor localization of cobalt-57-labeled porphine, 16: 20072

CHEMICAL ENGINEERING
developments, review, 16: 20312
uses of high vacuum technology in, 16: 20315

CHEMICAL PROPHYLAXIS
effectiveness in radiation injuries, 16: 20242

CHEMICAL RADIATION DETECTORS
performance of polymerization dosimeter, 16: 20857(R) (AD-265757)

CHEMICALS AND REAGENTS
corrosive effects on alloys and metals in chemical plants, 16: 20983
organic, for determination of titanium (IV), 16: 20349

CHEMISTRY
developments in inorganic, 16: 20364(T) (AEC-tr-4457)
molecular orbitals for nonsaturated compounds, computer program for calculation, 16: 20359 (NP-11530)
research progress under U. S. Army auspices, 1961, 16: 20043(R) (NP-11537)
research progress at Argonne National Lab., October to December 1961, 16: 20296(R) (ANL-6477)
research relating to nuclear energy, review of chemists' contribution, 16: 20309
theory of magnetic rotation spectra, 16: 21159
theory of stability of mixed complexes, 16: 20355 (IA-731)
translation of index to *Zhurnal Neorganicheskoi Khimii* (Journal of Inorganic Chemistry), Vol. 2, No. 1 to 12, 1957, 16: 20362(T) (AEC-tr-4434)

CHERENKOV DETECTORS
design for detecting beta particles in a liquid using rapid photomultipliers in coincidence, 16: 20712
design of large, 16: 20711
design using image intensifiers, 16: 20723

CHICKENS
effects of embryo irradiation on hemoglobin formation, 16: 20260

CHILE (TARAPACA)
uranium prospecting, 16: 20820 (RME-4568)

CHLORELLA
metabolism, effects of visible and ultraviolet light, 16: 20238

CHLORINE
corrosive effects on alloys and metals in chemical plants, 16: 20983
determination in chicken by neutron activation, 16: 20337
electron elastic scattering cross sections at 0 to 15 ev, 16: 21202

CHLORINE IONS
electron photodetachment cross sections, 16: 21202

CHLORINE ISOTOPES Cl-35
deuteron reactions (d,p) at 7.5 Mev, angular distributions from, 16: 21594

CHONDRITES
analysis for rare-earth and yttrium abundance activation, 16: 20841

CHROMATES
radiation effects, measurement of amount and composition of radiation products, 16: 20466 (AERE-R-3409)

CHROMATOGRAPHY
data interpretation and equipment development in, 16: 20316
mechanisms on paper impregnated with ion-exchange resins, 16: 20341
of labeled amino acids, apparatus for scintillometry of effluent, 16: 20347
paper, design of stainless steel support for cylindrical jars in ascending and descending, 16: 20342
uses of paper in radiochemistry, 16: 20469 (NAS-NS-3106)

CHROMIUM
brittle-ductile transition, 16: 21068
determination as trace in standard rocks G-1 and W-1, spectrographic, 16: 20831

CHROMIUM–COBALT–IRON–MOLYBDENUM–NICKEL ALLOYS
mechanical properties at room temperature to 2200°F, 16: 21025 (ASD-TR-61-499)

CHROMIUM–COBALT–NICKEL–TUNGSTEN ALLOYS
mechanical properties at room temperature to 2200°F, 16: 21025 (ASD-TR-61-499)

CHROMIUM COMPLEXES
with 3-cyanopentane-2,4-dione, stretching frequency of cyano group in, 16: 20421

CHROMIUM–IRON–MOLYBDENUM–NICKEL ALLOYS
corrosion by hydrofluoric acid in volatility pilot plant, 16: 20538 (ORNL-TM-186)
friction and wear testing, effects of beryllided and borided surfaces, 16: 21029 (DC-60-1-146)

CHROMIUM–IRON–NICKEL ALLOYS
friction and wear testing, effects of beryllided and borided surfaces, 16: 21029 (DC-60-1-146)
stress under tensile loading at 70 to 1200°F, effects of reamed and threaded holes, 16: 21027 (DC-59-12-216)

CHROMIUM ISOTOPES
nuclear potentials, evidence for distortion, 16: 21565

CHROMIUM ISOTOPES Cr-50
proton scattering at 2 to 5 Mev, resonances in, 16: 21543

CHROMIUM ISOTOPES Cr-51
determination in biological materials, radiochemical method, 16: 20658

CHROMIUM ISOTOPES Cr-52
proton scattering at 2 to 5 Mev, resonances in, 16: 21543

CHROMIUM–NICKEL ALLOYS
use in thermocouples, 16: 20633 (DC-59-10-202)

CHROMIUM–NICKEL–URANIUM OXIDE SYSTEMS
oxidation, effects of stress, temperature, and time, 16: 21028 (DC-60-1-108)

CHROMIUM OXIDES
catalytic effects on deuterium-hydrogen exchange, 16: 20433
radiation effects on films, on glass, 16: 21108

CHROMIUM SILICIDES
heats of formation, 16: 20394

CHROMOSOMES
radioinduced mutations in spermatogonia and spermatozoa of *Drosophila melanogaster*, 16: 20197

CIRCULATORY DISEASES
thyroid uptake of iodine-131, in patients with, 16: 20100

CIVIL ENGINEERING
reactor siting hazards analysis for high-flux experimental reactors, 16: 21744

CIVILIAN DEFENSE
hardening as optimum blast protection for minimum cost, 16: 20869 (NP-11653)

CLAYS
cation exchange properties of pelagic, 16: 20356 (JÜL-32-RC)
properties, effects of structure, 16: 21010(R) (AD-264878)
sorptive properties for strontium, effect of pH, 16: 20075

CLOUD-ION CHAMBERS
calibration and endurance testing, 16: 20648 (XDCL-59-2-722)

COBALT
alpha and carbon-12 reactions, gamma distributions from, 16: 21457
determination as trace in standard rocks G-1 and W-1, spectrographic, 16: 20831
determination in nuclear steels, neutron activation, 16: 20330
deuteron reactions (d, helium-3) at 21.6 Mev, determination of configurations of states by, 16: 21562
oxidation in carbon dioxide and carbon monoxide mixtures at 920 to 1200°C, 16: 20360 (NYO-10289)

COBALT(III) COMPLEXES
with bisethylenediamine and pentammine bromides, recoil chemistry of bromine in, 16: 20480
with 3-cyanopentane-2,4-dione, stretching frequency of cyano group in, 16: 20421

COBALT–COPPER ALLOYS
radiation damage on 12- to 50-Å precipitated particles in, 16: 21106
COBALT GLASS
radioinduced coloration in silicate, gamma, 16: 21099
COBALT ISOTOPES
nuclear potentials, evidence for distortion, 16: 21565
COBALT ISOTOPES Co-58
proton reactions (p,d) at 22 Mev, angular distributions from, 16: 21563
COBALT ISOTOPES Co-59
energy levels and E3 and E4 gamma spectra, 16: 21450
fluorine isotope reactions (F^{19},F^{18}) up to 43 Mev, 16: 21428
neutron reactions (n,2n) at 13.8 to 14.8 Mev, cross sections and isomeric ratios for, 16: 21385
proton reactions (p,α) at 18 Mev, seniority wave function effects on angular distributions and cross sections, 16: 21578
COBALT ISOTOPES Co-60
source and container design, 16: 20586(P)
COBALT OXIDES
diffusion in polycrystalline magnesium oxide, 16: 20395
radiation effects on films, on glass, 16: 21108
COBALT SULFATES
crystal structure, 16: 20305(R) (UCRL-10023)
COCKCROFT-WALTON ACCELERATORS
design for acceleration of protons and deuterons, 16: 21655
COFFINITES
occurrence and structure, 16: 20834
COINCIDENCE CIRCUITS
description of delayed-, for electron-electron cascades, 16: 21438
COINCIDENCE COUNTERS
application in localization of positron sources, 16: 20076
calibration of time-to-pulse-height converters, 16: 21439
computer analysis of proton, 16: 20636 (ISS-61/17)
design and performance of hodoscope, 16: 20772
design of 16-channel analyzer with high time resolution for, 16: 20775
design of 900-channel pulse-amplitude analyzer for, 16: 20776
performance for calibration of nuclides with complex decay schemes, 16: 20667
COINCIDENCE MEASUREMENTS
of nuclides with complex decay schemes, extrapolation method, 16: 20667
performance of scintillation detectors for delayed-, 16: 21434
review of delayed-, using pulsed-beam methods, 16: 21435
review of delayed-, on 0.1- to 10-nsec nuclear lifetimes, 16: 21440
COLLAGEN
radiation effects on shrinkage temperature, 16: 20182
COLLOIDS
use as propellant in spacecraft propulsion, 16: 21856
COLORADO PLATEAU
stream survey in uranium mining and milling area, 16: 20815 (NYO-7831)
COMBUSTION
ignition of 22 materials by atomic explosions, protective effects of window glass against, 16: 20860 (AFSWP-792)
COMPTON EFFECT
compensation in gamma spectrometry, 16: 20673
COMPUTER PROGRAMS
CELCOR for multiple lethargy level P1 or DSN cell corrections in cylindrical, spherical, and slab geometry, 16: 21721 (MND-C-2500-2)
code for calculation of neutron absorption in square lattices, 16: 21715 (BAW-154)
EQUIPOISE 3A, two-group neutron diffusion code, 16: 20930 (ORNL-3199(Add.))
for determination of first-collision neutron doses on IBM 7090, 16: 20877 (Y-1386)
for numerical solution of two-group diffusion equations, 16: 21341
for proton telescopes, IBM 610, 16: 20636 (ISS-61/17)
for tracing fission product buildup in reactors, 431, 16: 20935 (XDC-60-3-211)
Fortran for IBM 704, for Monte Carlo calculations for scattered gamma radiations, 16: 21693 (NP-11819)
LCAO-SCF, calculation of molecular orbitals for nonsaturated compounds, 16: 20359 (NP-11530)
MARC-1, analysis of thermal parameters in two-dimensional rectangular lattices, 16: 20933 (WAPD-TM-273)
MO150, for solution of one-dimensional, one-velocity transport in slabs, 16: 20934 (WAPD-TM-315)
OGRE-P1, for computing gamma radiation transmission through slabs, 16: 20931 (ORNL-TM-167(Rev.))
PARAMESH, input summary, 16: 20929 (MURA-635)
preparation for MTR-ETR analysis on IBM-650, 16: 21839(R) (IDO-16760)
Program 20-2, 20-3, 20-4, and 20-5 for calculation of cross section and shielding data, 16: 21691 (DC-60-7-9)
SHOC, thermal and hydraulic variables of boiling reactors, IBM-7090, 16: 20592(R) (EURAEC-264)
COMPUTERS
data processing for photoproduction reactions, 16: 20635 (ISS-61/7)
design of binary number comparator, 16: 20767
digital, use for calculating the motion of charged particles by average density method, 16: 21157
operation of IBM 1620, use of relocatable assembler for subroutines, 16: 20928 (AAEC/E-87)
programming for solution of design optimization, 16: 20555 (AAEC/E-8
use in computation of isodose distribution from interstitial radiation implantations, 16: 20112
CONCRETES
gamma absorption coefficients at 0.14 to 2.76 Mev, 16: 21695
gamma mass absorption coefficients at 0.14 to 1.32 Mev, 16: 21694
gamma reflection and transmission, Monte Carlo calculations of, 16: 21693 (NP-11819)
CONFERENCES
Aerodynamic Capture of Particles, Leatherhead, Surrey, 1960, 16: 21224
Electromagnetic Lifetimes and Properties of Nuclear States, Gatlinburg, Tenn., Oct. 5 to 7, 1961, 16: 21431 (NAS-NRC-Pub-974)
Eleventh Annual AEC Corrosion Symposium, Brookhaven National Lab., May 23 to 25, 1962, 16: 20975 (BNL-728)
Medical and Biological Aspects of the Energies of Space, San Antonio, Texas, Oct. 1960, 16: 20230
Nuclear Electronics, Belgrade, May 15–20, 1961, 16: 20757
Nuclear Electronics, Belgrade, May 15-20, 1961, 16: 20706
Nuclear Superheat Meeting No. 5, San Jose, California, Sept. 1961, 16: 21817 (TID-7630)
proceedings of the 1962 Heat Transfer and Fluid Mechanics Institute, Univ. of Washington, June 1962, 16: 20613
Rutherford Jubilee International Conference, Manchester, 1961, 16: 216
CONVECTION
analysis of combined free and forced, in laminar vertical flow, 16: 208
heat transfer between electrically conducting fluid and boundary surface magnetic field, 16: 20607
CONVERSION ELECTRONS
emission parameters, nuclear structure effects, 16: 21449
COPPER
alpha scattering at 43 Mev, excitation of collective levels by inelastic, 16: 21514
determination as trace in standard rocks G-1 and W-1, spectrographic, 16: 20831
determination in chicken by neutron activation, 16: 20337
determination in rare earth oxides, spectrographic method for, 16: 2027
determination of trace amounts by neutron activation, 16: 20345
deuteron reactions (d, helium-3) at 21.6 Mev, determination of configurations of states by, 16: 21562
deuteron sputtering at 0.8 to 2.5 Mev, 16: 21183
proton scattering, determination of shape of imaginary part of optical model potential in, 16: 21540
proton scattering at 9.4 Mev, polarization in elastic, 16: 21544
reactions with bismuth–uranium alloys, effects on liquid phase in, 16: 21071
sputtering with electric arc, characteristic stages, 16: 20968
COPPER COMPLEXES
with 3-cyanopentane-2,4-dione, stretching frequency of cyano group in, 16: 20421
COPPER CRYSTALS
radioinduced dislocation loops in, neutron, 16: 21102
radioinduced dislocation loops in, neutron, 16: 21104

COPPER–IRON–NICKEL ALLOYS
corrosion by hydrofluoric acid solutions, 16: 20042(R) (BNL-696)
corrosion by hydrofluoric acid–hydrogen peroxide mixtures, 16: 20534(R) (IDO-14574)
corrosion by hydrofluoric acid, 16: 20535(R) (IDO-14583)
COPPER ISOTOPES Cu-59
properties, 16: 21397
COPPER ISOTOPES Cu-61
properties, 16: 21397
COPPER ISOTOPES Cu-63
energy levels and E3 and E4 gamma spectra, 16: 21450
properties, 16: 21397
COPPER ISOTOPES Cu-65
properties, 16: 21397
proton inelastic scattering at low energies, reaction mechanisms for, 16: 21393
COPPER MINERALS
radioactivity in lower Silesia, 16: 20847
COPPER–NICKEL ALLOYS
corrosion by acids and chloride salts in chemical plants, 16: 20983
COPPER OXIDE FILMS
radiation effects on, applied to glass, 16: 21108
COPPER–TIN ALLOYS
phase studies, 16: 21040 (NP-11698)
COPPER–TITANIUM ALLOYS
crystal structure of Ti_4Cu, 16: 21074
CORROSION
conference, Brookhaven National Lab., May 23 to 25, 1962, 16: 20975 (BNL-728)
CORROSION LOOPS
development and testing program for mercury, 16: 20972 (AGC-0584-04-2)
COSMIC ALPHA PARTICLES
intensity measurements, Apr. 28, 1961, 16: 21254
spectra of solar, from Nov. 12 to 16, 1960, 16: 21239
COSMIC ELECTRONS
biological effects in space, 16: 20245
detection and measurement in soft component of radiation, 16: 21256
distributions in ionosphere on magnetically quiet and disturbed days, 16: 21247
COSMIC MESONS (μ)
attenuation length, distribution, and energy spectrum in extensive showers, 16: 21255
detection and measurement in soft component of radiation, 16: 21256
intensity variations at 40 mwe, 27-day recurrence tendency in, 16: 21252
scattering by iron and tin at 298 to 773 Mev/c, 16: 21248
spectra, integral-pulse, 16: 21249
COSMIC NUCLEONS
interactions above 10^{13} ev, measurement of showers from, 16: 20681
interactions with emulsion nucleons at 10^{10} to 10^{13} ev, angular distributions, 16: 21308
COSMIC PARTICLES
biological effects of carbon and heavier, 16: 20246
spectra of nuclear-active, integral-pulse, 16: 21249
spectra of primary, above 400 Mev/nucleon, 16: 21241
spectra of solar nuclear, from Nov. 12 to 16, 1960, 16: 21239
COSMIC PHOTONS
ionospheric effects of solar-flare-produced, 16: 21232
COSMIC PROTONS
biological effects in space, 16: 20245
detection and measurement in soft component of radiation, 16: 21256
energy spectrum, 16: 20239
interaction with matter and tissue, 16: 20239
spectra of geomagnetically trapped, anomalous component in, 16: 21243
spectra of solar, as a function of cutoff rigidity on Sept. 4, 1960, 16: 21240
spectra of solar, from Nov. 12 to 16, 1960, 16: 21239
COSMIC RADIATION
amplitude altitude dependence during Forbush decreases, 16: 21253
biological effects, 16: 20230
biological effects of secondary rays, 16: 20240
characteristics in space, 16: 20235
characteristics of galactic and solar, 16: 20245
distributions in outer radiation belt, angular and spatial, 16: 21244
dosage determinations in space vehicles, calculation principles, 16: 21844 (AD-263476)
effects on lunar surface, 16: 21132 (NP-11652)
geomagnetic fluctuation effects on, in Van Allen belts, 16: 21245
intensity variations with 2- to 200-day periods during IGY, 16: 21242
interaction of primary, with matter and tissue, 16: 20239
interactions of neutral, ionized solar streams with geomagnetic fields, 16: 21246
measurements from Explorer VI and Pioneer V with proportional counter telescope, 16: 20626 (AD-269307)
nuclei abundances above atmosphere, 16: 21250
particle flux and radiation dose rate from, 16: 20241
pathological effects of, 16: 20229
spectra of electromagnetic, 16: 20232
studies by Explorer XII, data summary, 16: 20851
COSMIC-RAY SPECTRA
measurement of energy and mass, from Nov. 12 to 16, 1960, 16: 21239
measurement of intensity and rigidity, for primary nuclei, 16: 21241
measurement of solar, as a function of cutoff rigidity on Sept. 4, 1960, 16: 21240
origin of non-solar, 16: 20232
COSMIC SHOWERS
attenuation length of extensive, in air, 16: 21251
measurement, microphotographic methods for, 16: 20681
meson (μ) measurements in extensive, 16: 21255
COSMOLOGY
electromagnetic theory, effects of properties of the universe, 16: 21237
Lee-Yang vector field and isotropy of the universe, 16: 21236
COUNTING DEVICES
circuit with dead-time loss compensation, 16: 20696(P)
design of 50-kc transistorized decade scaler, 16: 20676
CRITICAL ASSEMBLIES
age to thermal, effective delayed neutron fractions, and fast fission factor in heterogeneous lattices, 16: 21710 (AEET/RE/1)
conference on nuclear superheat projects, 16: 21817 (TID-7630)
description of fast, 16: 21732
design of Argonne Thermal Source Reactor, 16: 21714 (ANL-6440)
hazards evaluation of CANEL, 16: 21725 (PWAC-139)
multiplication constants for bare, 16: 21728 (XDC-60-1-211)
CRITICALITY STUDIES
summary of 4% enriched MARTY, 16: 21257 (BAW-1216)
CROSS SECTIONS
analytic properties of partial differential, 16: 21290
CRYSTAL DETECTORS
performance of cadmium sulfide, 16: 20663
CRYSTAL STRUCTURE
behavior of linear isotopic random; time-dependent, 16: 21168
correlations in classical order-disorder phenomena, 16: 21180
dynamics of cubic, with a local change of mass, 16: 21186
electric conductivity of electron-phonon systems, 16: 21166
exciton Bose-Einstein condensation, 16: 20470(R) (NP-11604)
CRYSTALS
anharmonic contributions to specific heat, 16: 21185
electron energy losses and collective excitations in, 16: 21182
luminescence mechanisms, 16: 20376(T) (AEC-tr-5110)
models, proposal for exactly soluble, 16: 21204
phonon elastic scattering in anisotropic, 16: 21198
radioinduced aggregation of interstitial atoms and vacancies, neutron, 16: 21103
wave motions in, theory of, 16: 21709
CURIUM ISOTOPES Cm-242
fission, probability of emission of long-range particles, 16: 21420
CURIUM ISOTOPES Cm-244
fission, probability of emission of long-range particles, 16: 21420
CYANIDE IONS
heat of formation from graphite and nitrogen, 16: 20405
CYANO GROUP
stretching frequency in metal complexes with 3-cyanopentane-2,4-dione, 16: 20421
CYANOGEN

production from elements using plasma jet, 16: 20392
CYCLOPENTANE, METHYL-
radiolysis in presence of xenon, 16: 20524(P)
CYCLOPROPANE
radiolysis in presence of xenon, 16: 20524(P)
CYLINDERS
neutron diffusion and transport in water containing, void effects, 16: 21330 (AD-267646)
strain hardening in yielded compound, theory, 16: 20965
CYSTEINE
protective effects against radiation in T phages, 16: 20293
CYTOCHROME C
radiation effects on dry and aqueous solution, 16: 20142
CZECHOSLOVAKIA
radioactivity of drinking, river, and waste waters, Prague, 16: 20878(T) (AECL-1498)

D

DAREX PROCESS
dissolver solutions, corrosive effects on container materials, 16: 20537(R) (ORNL-TM-177)
flowsheets, 16: 20536 (ORNL-2712)
removal of silica, 16: 20537(R) (ORNL-TM-177)
DATA RECORDING SYSTEMS
design for processing data from multi-channel analyzers, 16: 20771
design of address scaler and temporary memory for a transistorized time-of-flight analyzer, 16: 20763
design of automatic, for pulse analyzers, 16: 20778
design of intermediate arithmetic memory for, 16: 20768
design of LODESTAR, a new counter data-handling facility, 16: 20770
design of multi-measuring tape-recording system with statistical equalizing, 16: 20764
design of 256-channel, 16: 20781
multi-channel recording of a pulse spectrum on the screen of a Williams tube used with a ferrite memory analyzer, 16: 20761
DECAY CURVES
coincidence calibration for nuclides with complex decay schemes, 16: 20667
DECAY SCHEMES
theory, S matrix formalism in, 16: 21617
DECONTAMINATING SOLUTIONS
effectiveness for removing thallium-204 from skin, 16: 20895
DECONTAMINATION
evaporator design for, 16: 21861
methods for water cooled reactors, 16: 20984
DELAYED NEUTRONS
effectiveness in heterogeneous lattices, 16: 21710 (AEET/RE/1)
DETONATION WAVES
explosion product distribution in, effects of chemical structure and dispersion, 16: 20375(T) (AEC-tr-5100)
DEUTERIDES
electron scattering at 41.4 Mev, cross sections, 16: 21640
DEUTERIUM
determination in water, mass spectrometric, 16: 20333
exchange between decaborane and deuterium chloride, 16: 20397
exchange between hydrogen and water in vapor phase, kinetics of, 16: 20923 (NP-11789)
exchange between hydrogen and water, 16: 20927(P)
exchange with anisole, benzene, and thioanisole, acid-catalyzed, 16: 20306
exchange with hydrogen in solid potassium hydroborate, 16: 20401
exchange with hydrogen on chromium, titanium, and vanadium sesquioxides, 16: 20433
exchange with tritium in thiophene, 16: 20383
production by catalytic isotope exchange with water, 16: 20927(P)
reactions with ethyl radicals, effects of vibrational excitations in, 16: 20408
recombination with oxygen in thorium oxide slurries, catalyst, 16: 20310(P)
DEUTERONS
angular distributions from neutron reactions with vanadium-51, 16: 21554
capture by deuterons, helium-4 structure from, 16: 21274
detection and measurement, semiconductor detector systems for, 16: 20746
energy spectra from proton interactions with carbon and gold at 154 Mev, 16: 21488
interactions with neutrons at 14.4 Mev, determination of neutron-neutron scattering length from, 16: 21472
interactions with protons at 135 Mev, angular distributions and energy spectra of neutrons from, 16: 21475
interactions with mesons (K^-), total cross sections at 630 to 1100 Mev, 16: 21360 (UCRL-10125)
magnetic dipole disintegration, 16: 21640
properties in nuclear matter, size and energy, 16: 21403
reactions (d,α) with aluminum-27 at 10 Mev, evidence for (2I+1) rule in, 16: 21515
reactions (d,α) with carbon-13 at 3.26 and 3.45 Mev, angular distributions and double pick-up of inequivalent nucleons in, 16: 21577
reactions (d, helium-3) with nuclei near Z = 28 at 21.6 Mev, determination of configurations in states by, 16: 21562
reactions (d,a) and (d,p) with nuclei, structure effects in, 16: 21584
reactions (d,n) with boron-11 at 2.65 and 5.35 Mev, distorted-wave effects in, 16: 21587
reactions (d,n) with beryllium-9 at 2 to 4 Mev, angular distributions from, 16: 21588
reactions (d,n) with carbon-12 at 4 Mev, angular distributions and excitation curves from, 16: 21589
reactions (d,n) with boron-11, shell model analysis, 16: 21353 (NP-11681)
reactions (d,p) with boron-10 at 12.5 to 21.5 Mev, energy dependence of angular distribution in, 16: 21559
reactions (d,p) with lead-206 at 8.3 to 15 Mev, Coulomb-distorted angular distributions from, 16: 21580
reactions (d,p) with calcium-41, carbon-13, and magnesium-25 at 10.8 Mev, polarization in, 16: 21581
reactions (d,p) with magnesium-24 at 10 Mev, angular distributions from, 16: 21592
reactions (d,p) with boron-10 at 10.1 Mev, angular distributions from, 16: 21593
reactions (d,p) with chlorine-35 at 7.5 Mev, angular distributions from, 16: 21594
reactions (d,p) with lithium-7 at 2 to 4 Mev, distorted-wave calculations of cross sections, 16: 21596
reactions (d,p) with nuclei at 15 Mev, angular dependence of proton polarization in, 16: 21597
reactions (d,p) with carbon-12 at 6 Mev, effects of proton spin-orbit distortion on angular distributions and polarization, 16: 21599
reactions (d,p) with nuclei, proton spin-orbit distortion effects in, 16: 21600
reactions (d,p) with nuclei, graphs for determining reduced widths in, 16: 21356 (NYO-2666)
reactions (d,pγ) with beryllium-9, distorted-wave analysis, 16: 21553
reactions (d,t) with nickel isotopes at 21.6 Mev, angular distributions and cross sections, 16: 21557
reactions with beryllium-9 and carbon-12 at 1 and 1.3 Mev, cross sections for capture, 16: 21638
scattering by carbon at 125 to 422 Mev, cross sections and polarization, 16: 21467
scattering by carbon at 1 to 1.46 Mev, elastic, 16: 21629
scattering by light nuclei at 13 Mev, angular distributions from elastic, 16: 21566
scattering by samarium-154 and selenium-78 at 11 Mev, 16: 21504
sputtering of copper by 0.8- to 2.5-Mev, 16: 21183
DIDO REACTORS
neutron capture-to-fission ratio in uranium-233, in PLUTO, 16: 21372
DIELECTRIC BREAKDOWN
voltage measurement in, irradiation of small sphere gaps for, 16: 20571
DIET
analysis for radioactivity, 16: 20905
cesium-137 content in Argentina, 1961, 16: 20856 (A/AC.82/G/L.746)
radiosensitivity effects of deficient, on survival of albino mice and rats, 16: 20130 (NP-11741)
DIODES

theory of crystal, 16: 21709
DISASTERS
legal aspects and remedies in England, 16: 20052
DISCONNECTS
design calculations for remote quick, 16: 20561 (DC-59-9-154)
DISEASES
pathogenesis of meningitis in dogs, 16: 20094
radiotherapy of rheumatoid arthritis, distribution of gold-198 in body, 16: 20083
DISSOLVERS
development of electrolytic for nuclear fuels, 16: 20535(R) (IDO-14583)
DISTILLATION APPARATUS
design of fractional, with radiation sources for producing stable hydrocarbon distillates, 16: 20921(P)
DODECENE
yields in dehydration of n-dodecyl alcohol, radiation effects on catalytic activity of aluminum oxide in, 16: 20482
DODECYL ALCOHOL
dehydration, radiation effects on catalytic activity of aluminum oxide, 16: 20482
DOLOMITES
porosity of aquifers of, determination by tracer methods, 16: 20840
DOUNREAY FAST REACTOR
design, 16: 21732
operation and problems, 16: 21831
DRESDEN POWER REACTOR
fuel containing thorium, feasibility, 16: 21736
DROPS
acceleration and preparation of charged, effects of source operating conditions, 16: 20567 (NP-11533)
DROSOPHILA
radiation effects, genetic, 16: 20175
radiation effects, genetic, 16: 20176
radioinduced mutations in spermatogonia and spermatozoa, 16: 20197
DRUGS
distribution and excretion of labeled perphenazine in rats, 16: 20084
DUSTS
radioactivity in Japan, July to Sept. 1961, 16: 20129
radioactivity in Osaka, Japan, 1961, 16: 20121
radioactivity of air-borne, in Japan in fall 1961, 16: 20122
DYSPROSIUM
magnetostriction at 2k to 206°K, 16: 21214
specific heat at 0.4 to 4°K, 16: 21190
DYSPROSIUM–HAFNIUM ALLOYS
corrosion rates at 1000°C, 16: 20971(R) (AD-266150)
DYSPROSIUM ISOTOPES
nuclear gyromagnetic ratios and quadrupole moments, 16: 21446
DYSPROSIUM ISOTOPES Dy-156
behavior at excitation energies of 65 to 125 Mev, 16: 20305(R) (UCRL-10023)
DYSPROSIUM ISOTOPES Dy-160
gamma spectra, E2 emission parameters, 16: 21444
DYSPROSIUM ISOTOPES Dy-161
gamma spectra, E2 emission parameters, 16: 21444
nuclear magnetic moments in iron garnet, 16: 21526
nuclear properties, study by Mössbauer effect, 16: 21447
DYSPROSIUM ISOTOPES Dy-162
gamma spectra, E2 emission parameters, 16: 21444
DYSPROSIUM ISOTOPES Dy-163
gamma spectra, E2 emission parameters, 16: 21444
DYSPROSIUM ISOTOPES Dy-164
gamma spectra, E2 emission parameters, 16: 21444

E

ECOLOGY
of fish, labeling with cesium-137, 16: 20069
EGGS
cesium-134, iodine-131 and strontium-89 deposition in hen's, 16: 20109
EGYPT
iodine-131 content in animal thyroids and milk, 1956 to 1957, 16: 20125
EINSTEINIUM ISOTOPES Es-253
alpha decay, preferential polar emission, 16: 20305(R) (UCRL-10023)
ELASTOMERS
development of high-temperature, 16: 20350(R) (AGC-0423-01-3)
ELECTRIC ARC FURNACES
design for production of alloy samples from reactive metals, 16: 20989 (ASD-TN-61-32)
ELECTRIC CONDENSERS
design of plasma, 16: 21689(P)
photoconductivity of Mylar, effects of gamma radiation, 16: 21088 (DOFL-TR-1037)
ELECTRIC CURRENTS
measurement of limiting and mass transfer polarization, 16: 20305(R) (UCRL-10023)
ELECTRIC DISCHARGE
constriction, volt-ampere characteristics, and volume recombination of the positive column, 16: 21179
spectra in high frequency, Balmer, 16: 21143(T) (NP-tr-886)
thermodynamic equilibrium in spark plasmas, 16: 21687
ELECTRIC FIELDS
effects on radioinduced polymerization, 16: 20471 (NYO-9485)
electron mobility in intense, 16: 21282
ELECTRIC INSULATORS
radiation effects on polyethylene, 16: 20518
ELECTRIC MOMENTS
upper limits for longitudinal dipole, for photons, 16: 21314
ELECTRIC POWER
generation by two-fluid magnetohydrodynamic cells, 16: 21151
ELECTRICAL ENGINEERING
research progress under U. S. Army auspices, 1961, 16: 20043(R) (NP-11537)
ELECTRICITY
impedance properties as causal operator, 16: 21277
ELECTROCHEMICAL ANALYSIS
developments in, 16: 20353(R) (EURAEC-241)
ELECTRODYNAMICS
mass constancy for low moments, 16: 21700
structure-independent, in the electric-dipole approximation, 16: 21705
theory, cosmological effects on time symmetry and charge properties, 16: 21237
ELECTROLYTIC CELLS
operation, prediction from mass balances and voltages, 16: 20305(R) (UCRL-10023)
ELECTROMAGNETIC FIELDS
charged particle motion in, 16: 21672
interactions with plasmas, 16: 21661 (AFCRL-746)
ELECTROMAGNETIC WAVES
effects of intense on solids, 16: 21087(R) (AFOSR-2483)
Einstein-Maxwell equation symmetries, 16: 21164
emission by electrons moving in medium at super-light velocity, stability, 16: 21316
hazards from, in space, 16: 20244
shielding in space vehicles, 16: 20244
solutions in general relativity, 16: 21207
theory, cosmological effects on time symmetry and charge properties, 16: 21237
theory, general-relativistic quantum mechanical, 16: 21709
ELECTROMAGNETISM
theory, cosmological effects on time symmetry and charge properties, 16: 21237
ELECTROMIGRATION SEPARATION
uses in radiochemistry, 16: 20469 (NAS-NS-3106)
ELECTRON BEAMS
current measurement, secondary electron monitor, 16: 20652
current measurement, nonobstructive secondary electron monitor, 16: 20653
measurement of absorbed dose, performance of scintillation dosimeter, 16: 20688
optics, electronic simulation of lens-aberration effects in, 16: 21155
performance in space-charge neutralization of ion beams, 16: 21152
power measurement, calorimeter, 16: 20651
ELECTRON CAPTURE
charge-transfer approximations for, 16: 21273

in slow collisions, 16: 21122 (AFCRL-1062-II)
ELECTRON CAPTURE CROSS SECTIONS
calculation, 16: 21122 (AFCRL-1062-II)
ELECTRON LENSES
aberration effects on beams, electronic simulation, 16: 21155
ELECTRON PAIRS
production by meson (π^-) capture in hydrogen, 16: 21315
ELECTRON SOURCES
characteristics of duoplasmatron as, 16: 20649(T) (FTD-TT-62-480)
ELECTRON TUBES
design for treating inert gases for chemical combination, 16: 20580(P)
use of E1T, in radiation detectors, 16: 20802
use of transistor-driven decade counter tubes in scalers, 16: 20801
ELECTRONIC EQUIPMENT
conference on nuclear, 16: 20757
conference on nuclear, 16: 20706
design for generating high temperatures, 16: 20588(P)
development at Orsay, 16: 21647(R) (LAL-1021)
ELECTRONS
attachment in oxygen molecules, mechanisms of low-energy, 16: 20407
behavior in chromospheric flares, 16: 21238 (NP-11658)
biological effects on skin and tumors, dependence on dose fractionation and time, 16: 20224
capture from atomic hydrogen by protons, 16: 21200
capture into stable betatron orbits, 16: 21651 (SIT-P53)
collective excitations and energy losses in crystals, 16: 21182
density enhancement around positive point charges in, 16: 21201
density in plasma from optical refractivity, 16: 21673
detection and measurement using thallium-activated sodium iodide scintillators, 16: 20713
detection of low-energy, by beta particle spectrometer, 16: 20645 (TID-15742)
diamagnetic shielding of nuclei by, in metals, 16: 21215
distribution functions in anisotropic metals, Boltzmann equation, 16: 21211
distribution in plasma, determination by use of Pound stabilized oscillators, 16: 21113 (AD-266197)
dosage determinations by detector using radioinduced polymerization, 16: 20857(R) (AD-265757)
drift velocities in gases, diffusion-induced errors in, 16: 21154
emission, r-f deflection method for analyzing delayed-coincidence, 16: 21438
energy distribution from heavy-particle ionizing collisions, 16: 21346 (ARL-185)
gases at high temperatures in solids, perturbation effects, 16: 21217
interactions with protons at large recoil angles and momenta, 16: 21313
ionization by 150 to 550 Mev, in gases, 16: 21288
magnetic properties of relativistic gases, 16: 21675
magnetic properties of Bloch-type, 16: 21176
mobility in intense electric fields, 16: 21282
model for ground-state and excited states, 16: 21327
radiation from accelerated, traveling-wave computation of, 16: 21281
range of excited, in metals, 16: 21197
reactions with hydrogen peroxide, dissociation and ionization in, 16: 20410
reactions with noble gases, emission spectra excitation, 16: 21147
recombination with atomic ions, collisional-radiative processes in plasma, 16: 21683
removal of free, from plasma, 16: 21679
scattering by carbon, nucleus shell structure determinations from, 16: 21471
scattering by carbon, chlorine, fluorine, and oxygen, elastic, 16: 21202
scattering by helium and hydrogen, differential cross sections, 16: 21121 (AFCRL-1062-I)
scattering by nuclei, momentum transfer and Pauli correlations in, 16: 21474
scattering from carbon, carbon deuteride, and carbon hydride at 41.4 Mev, cross sections, 16: 21640
temperature in shock-induced plasma, 16: 21668(T) (AERE-Trans-893)
wave functions of single, in f shell of atoms, 16: 21212
ELECTROPHORESIS
use in separation of inorganic ions in fused salts on glass fiber paper, 16: 20550
ELECTROSTATIC GENERATORS
design of 300 kev fast neutron, 16: 21657
development for rocket propulsion, 16: 21858
developments for use in spacecraft propulsion, 16: 21855
ELECTROSTATIC PRECIPITATORS
design for detecting fuel element failure in gas-cooled reactors, 16: 21782(P)
design for monitoring reactor cooling gas, 16: 21776(P)
design for precipitation on a small portion of wire, 16: 20581(P)
ELEMENT ONE HUNDRED AND THREE
production and properties, 16: 20305(R) (UCRL-10023)
ELEMENTARY PARTICLES
connection between gauge invariance and mass, 16: 21324
conserved vector current hypothesis for, verification of, 16: 21321
decay of neutral, circular polarization measurement in gamma rays from, 16: 21265 (NP-11600)
decay, study of rare modes using an image-intensifier system, 16: 20719
detection and production of polarized, 16: 21262 (CERN-62-8)
Dirac equations, solutions for modified, 16: 21261 (AFOSR-TR-60-172)
electromagnetic properties of unstable, 16: 21301
electromagnetic wave emission by relativistic, 16: 21316
gyroscopic motion, use in measuring angular velocity, 16: 21269(T) (FTD-TT-61-23)
interactions at high energies, resonance mechanisms for, 16: 21303
interactions, dispersion relation causal operator relation to electric impedance, 16: 21277
interactions, global symmetries and selection rules for weak, 16: 21298
interactions, many-body potentials for, 16: 21304
interactions of free, with systems of identical bound, 16: 21312
interactions, partial differential cross sections for, 16: 21290
interactions, S-matrix theory of strong, 16: 21329
interactions, symmetries and electromagnetic form factors of strong, 16: 21302
interactions, unitarity symmetry for weak, 16: 21305
lectures, 16: 21263 (CERN-62-14)
many-body systems, models for, 16: 21502
mass constancy for low momenta, 16: 21700
production in hyperon (Ξ^-) and ($\bar{\Xi}^+$) interactions with protons, resonance, 16: 21287
production of low-energy, in CERN proton synchrotron, 16: 21645 (CERN-62-19)
reactions via single particle modes, review of direct, 16: 21266 (NP-11680)
S-matrix theory, lectures, 16: 21267 (UCRL-9875(Vol.2))
scattering amplitude analyticity in complex angular momentum of relativistic S-matrix, 16: 21698 (AFOSR-2400)
scattering by single attractive Yukawa potential, Regge trajectories of poles in S matrix for, 16: 21268 (UCRL-10140)
ELEMENTS
determination in biological materials, roentgenofluorimetric, 16: 20097
distribution in the universe, theory, 16: 21226(T) (UCRL-Trans-804(L))
spectra for hydrogen to niobium (Z = 1 to 41), finding list to ultraviolet multiplet table, 16: 20358 (NBS-C-488(Sect.4))
spectra for Z = 42 to 57 and 72 to 88, table of ultraviolet multiplets, 16: 20357 (NBS-C-488(Sect.3))
EMBRYOS
phosphorus distribution in organs, tracer study, 16: 20110
radiation effects on subsequent hemoglobin formation, 16: 20260
radiation effects on development of anlage of tibia and fibula in leg buds, 16: 20164
EMISSION SPECTRA
line widths of rare-earth ions in crystalline salts, 16: 21205
measurement in pure alpha- and electron-excited noble gases, 16: 21147
ENDOCRINE GLANDS
radiation effects, review of secondary, 16: 20291
ENGINEERING TEST REACTOR
operation, effects of fuel element rupture-coolant flow blockage, 16: 21719 (IDO-16780)
ENGLAND
fission product content in drinking waters, 16: 20126

ENZYMES
effects of cancer radiotherapy on serum beta-glucuronidase activity, 16: 20258
effects of whole-body irradiation on, in regenerating liver in rat, 16: 20255
radiosensitivity of liver, 16: 20915
synthesis of deoxyguanylate kinase in phage-infected *E. coli*, 16: 20095
EPITHELIUM
radioinduced carcinoma in bronchial, in rat lung, 16: 20147
radioinduced carcinoma in alveolar, in rat lung, 16: 20148
EQUIPMENT AND PROCEDURES
development for evaluation of thermal stress resistance of high-temperature materials, 16: 21030 (DC-60-3-110)
development for hazards control, 16: 20875(R) (UCRL-6818)
device for producing discontinuous rotary movements, 16: 20579(P)
ERBIUM CHLORIDES
spectra of erbium ions in, line widths of emission, 16: 21205
ERBIUM ETHYL SULFATES
spectra of erbium ions in, line widths of emission, 16: 21205
ERBIUM IONS
spectra in crystalline salts, line widths of emission, 16: 21205
ERBIUM ISOTOPES
nuclear gyromagnetic ratios and quadrupole moments, 16: 21446
ERBIUM ISOTOPES Er-164
gamma spectra, E2 emission parameters, 16: 21444
ERBIUM ISOTOPES Er-166
gamma spectra, E2 emission parameters, 16: 21444
ERBIUM ISOTOPES Er-167
gamma spectra, E2 emission parameters, 16: 21444
ERBIUM ISOTOPES Er-168
gamma spectra, E2 emission parameters, 16: 21444
ERBIUM ISOTOPES Er-170
gamma spectra, E2 emission parameters, 16: 21444
neutron capture cross sections, 16: 20302(R) (ANL-6477(p.217-23))
ERBIUM NITRATES
spectra of erbium ions in, line widths of emission, 16: 21205
ERYTHROCYTES
life span, tracer study, 16: 20056
mass, tracer study, 16: 20055
potassium and sodium metabolism in patients with cardiac insufficiency, 16: 20101
radiation effects on iron metabolism and osmotic resistance, 16: 20156(T)
transmission across mouse placenta, radiation effects, 16: 20066
ERYTHROPOIESIS
radiation effects in pregnant mice, 16: 20190
ESCHERICHIA COLI
deoxyribonucleic acid replication and enzyme synthesis in T4 phage-infected, 16: 20095
radiation effects of alpha particles on induction of K 12 (λ), 16: 20140
radiosensitivity, effects of 5-fluorouracil pretreatment, 16: 20149
ribosome structures, 16: 20103
ESTRADIOL
protective effects in gamma-irradiated male and female rats, 16: 20183
ETHANE
decomposition of vibrationally excited, 16: 20408
ETHANETHIOL, 2-AMINO-
protective effect against radiation in T1 phages, 16: 20294
protective effects against radiation on *Bacterium cadaveris*, 16: 20142
protective effects against radiation in embryo intestine and testis, 16: 20186
protective effects against radiation damage to mitotic cells of *Vicia faba*, 16: 20219
protective effects against radiation in T2 bacteriophages during intracellular cycles, 16: 20292
protective effects against radiation in T phages, 16: 20293
ETHANOL
dissociation, effects of irradiated zinc oxide catalyst, 16: 20509
etching effects on lithium fluoride crystals, adsorption-locking and Rebinder effect in, 16: 20437
ETHYL RADICALS
decomposition of vibrationally excited, 16: 20408
measurement of lifetime, 16: 20472(R) (RRL-79)
reactions with deuterium or hydrogen, effects of vibrational excitations in, 16: 20408
ETHYLENE
radioinduced polymerization, 16: 20042(R) (BNL-696)
spectra, isotope effects on proton magnetic resonance, 16: 20429
ETHYLENE, CHLORO- POLYMERS
radioinduced gelatin, mechanism, 16: 20504
radiolysis, determination of free radical production by electron paramagnetic resonance, 16: 20486
ETHYLENE POLYMERS
properties of irradiated for deuterium-hydrogen exchange, 16: 21010(R) (AD-264878)
radiation effects on Marlex, 16: 20534(R) (IDO-14574)
radiation effects on insulation, 16: 20518
EUROPEAN ATOMIC ENERGY COMMUNITY
activities, April 1960 to March 1961, 16: 20045 (NP-11611)
EUROPIUM CHLORIDES
double refraction in the hexahydrate, anomalous dispersion of, 16: 20386
EUROPIUM COMPLEXES
ion association in, solvent extraction and tracer studies, 16: 20452
EUROPIUM ISOTOPES
nuclear gyromagnetic ratios and quadrupole moments, 16: 21446
EUROPIUM ISOTOPES Eu-150
decay schemes, 16: 21396
EUROPIUM ISOTOPES Eu-152
spectra of 13-year, 16: 20305(R) (UCRL-10023)
EUROPIUM ISOTOPES Eu-153
gamma spectra, E2 emission parameters, 16: 21444
EVAPORATORS
control system for waste process, 16: 20534(R) (IDO-14574)
design and efficiency for radiochemical waste system, 16: 21861
EXCRETION
effects of radiotherapy of cervix carcinomas on various substances, 16: 20254
EXOSPHERE
distribution of ions in, and whistling atmospherics, 16: 21120 (AFCRL-62-294)
emission of white radio-wave noise at 1 to 10 kc, 16: 21231
EXPERIMENTAL BOILING WATER REACTOR
development, 16: 21794(R) (ANL-6565)
EXPERIMENTAL BREEDER REACTOR
design, 16: 21732
development, 16: 21794(R) (ANL-6565)
EXPERIMENTAL BREEDER REACTOR-II
design and performance, 16: 21732
development, 16: 21794(R) (ANL-6565)
fuel processing facilities for, 16: 20297(R) (ANL-6477(p.29-105))
EXPLODING WIRE PHENOMENA
use in testing structural response to intense electromagnetic radiation, 16: 21087(R) (AFOSR-2483)
EXPLOSIONS
product distribution in, 16: 20375(T) (AEC-tr-5100)
seismic amplitudes of chemical and nuclear, effects of depth or altitude, 16: 20823
EXPLOSIVES
detonation of mixed, explosion product distribution in, 16: 20375(T) (AEC-tr-5100)
EXPONENTIAL PILES
neutron flux distribution in, of regular slab geometry and of finite height, 16: 21730
EXTERNAL COMBUSTION ENGINES
force and torque variations of 36-cylinder double-acting, 16: 20556 (AD-269392)
EXTRACTION APPARATUS
performance of Scheibel extractor, role of packing in determining concentration and drop size, 16: 20547
EXTRUSION
lubrication of apparatus for, 16: 21003(P)
EYES
effects of irradiation on ovary grafts in, in mice, 16: 20139
pigmentary neoplasm diagnosis using phosphorus-32, 16: 20073
radiation cataract production by traumatization, 16: 20165

radiation effects on excitability of nictitating membrane in cats, 16: 20143

F

FALL-OUT
book: *The Effects of Nuclear Weapons*, 16: 20908
contamination of milk through exposed cattle or contaminated pastures, 16: 20124
detection device using adhesive tape, 16: 20664
fission product content in drinking waters in England, 16: 20126
iodine-131 contents of animal thyroids and milk in Egypt, 1956 to 1957, 16: 20125
iodine-131 content of milk in Italy, Oct. to Dec. 1961, 16: 20127
monitoring, Argentina, 1961, 16: 20856 (A/AC.82/G/L.746)
monitoring at Mol, 1960, 16: 20812(R) (A/AC.82/G/L.711)
monitoring at Mol, 1960, 16: 20813(R) (A/AC.82/G/L.721)
monitoring atmospheric, Germany, 1961, 16: 20846
monitoring in Alpine precipitation, grass, and glaciers in 1960, 16: 20883
monitoring in drinking, river, and waste waters, Prague, 16: 20878(T) (AECL-1498)
monitoring in France, 1951-1962, 16: 20887
monitoring in Germany, 1953-61, 16: 20128
monitoring in U.S., 1960 and 1961, 16: 20905
monitoring in U.S., 1961, 16: 20906
monitoring in U.S., 1961 and 1962, 16: 20907
monitoring, New Jersey, 1960–1961, 16: 20816 (NYO-9531)
radiation dose from, 16: 20229
radioactivities in rain water, dusts, weeds, and sea water in Osaka, Japan, 1961, 16: 20121
radioactivities of rain and dusts in Japan, July to Sept. 1961, 16: 20129
radioactivity of air-borne dusts in Osaka, Japan, fall 1961, 16: 20122
FAST NEUTRONS
attenuation functions, modified coefficients for, 16: 21335 (XDC-60-2-76)
effects on 12- to 50-Å precipitated particles in metals, 16: 21106
fission factor in heterogeneous lattices, 16: 21710 (AEET/RE/1)
penetration effects in moderators, 16: 21337
reactions (n,α) with silicon-28 at 13.5 to 14.7 Mev, cross-section oscillations in, 16: 21413
reactions with fluorine, evidence of direct processes in, 16: 21549
spectra of thermal-neutron-induced, in natural uranium, 16: 21338
FAST REACTORS
design feasibility of uranium-233–thorium breeder, 16: 21723 (NDA-2134-3)
design of critical assemblies and breeder, power, and research reactors over the world, 16: 21732
kinetic behavior, comparison with thermal reactors, 16: 21743
reactivity of dilute, effects of sodium coolant loss, 16: 21711 (AEEW-M-225)
testing, facility development, 16: 21794(R) (ANL-6565)
FASTENERS
properties evaluation and comparison with captive nuts and bolts, 16: 20563 (DC-60-12-129)
FATTY ACID ESTERS
protective effects of unsaturated, against radiation sickness in gonads of male mice, 16: 20285
FATTY ACIDS
radioinduced formation in bovine rumen, 16: 20206
FERMI FAST BREEDER REACTOR
design and performance, 16: 21732
FERMIONS
energies of systems having strong interactions, 16: 21292
FERTILIZERS
preparation of labeled phosphate, 16: 20475(T) (CEA-tr-X-434)
FETUSES
effects of mother irradiation on mouse, malformations, 16: 20187
phosphorus distribution in organs, tracer study, 16: 20110
radioprotective effects of liver, spleen, and bone marrow cells in, 16: 20160
serum albumin uptake from mouse mother, radiation effects, 16: 20067
FIELD FORTIFICATIONS
blast protection by hardening, 16: 20869 (NP-11653)
FIELD THEORY
book: *S-Matrix Theory of Strong Interactions*, 16: 21329
connection between gauge invariance and mass, 16: 21324
electron model, for ground state and excited (muon) state, 16: 21327
Lee-Yang vector field and isotropy of the universe, 16: 21236
models for crystals, exactly soluble, 16: 21204
momentum-space vertex function analyticity properties, 16: 20937
motion in asymmetric, 16: 21283
nucleon potential in, from double dispersion relations and unitarity, 16: 21402
operator algebra structure, 16: 21173
operator product analytic properties, 16: 20939
structure-independent electrodynamics in the electric-dipole approximation, 16: 21705
vacuum expectation value in, perturbation expansion of, 16: 20938
FILTERS
design and performance of fibrous, for collecting radioactive particles, 16: 20575
design for clean rooms, 16: 20874 (SC-4673(RR))
FINNED TUBES
design of splitter fin body for finned reactor fuel elements, 16: 21779(P)
FISH
analysis for radioactivity after ingestion of iron-59, 16: 20059
labeling with cesium-137 in ecological studies, 16: 20069
strontium-90 uptake by gills, 16: 20106
FISSION
research summary, 16: 20305(R) (UCRL-10023)
FISSION PRODUCTS
angular distribution, counter design for study of, 16: 20736
detection and measurement, use of thallium-activated cesium iodide foil, 16: 20669
detection and measurement of short-lived, in gas flow, 16: 20692(P)
diffusion in aluminum, 16: 20042(R) (BNL-696)
diffusion of gaseous, in uranium (IV) oxides, 16: 21091(R) (EURAEC-248)
emission probability from heavy nuclei, 16: 21420
neutron absorption cross sections for stable, 16: 21361 (XDC-60-1-141)
reactor criticality effects, uncertainties in predicting, 16: 21814 (KAPL-M-ECH-8)
recovery by ion exchange, 16: 20537(R) (ORNL-TM-177)
release from bismuth–uranium compounds at 800°C, 16: 20042(R) (BNL-696)
release from irradiated uranium dioxide, mechanisms of gaseous, 16: 21043(T) (AEC-tr-5103)
uptake by plants, effects of soil composition, 16: 20885
uptake by plants, effects of soil composition, 16: 20886
FISSIONABLE MATERIAL
transportation, methods used in, 16: 20896
FLOWMETERS
design of electromagnetic, for high temperatures and pressures, 16: 20624(P)
FLUID FLOW
conference, Univ. of Washington, June 1962, 16: 20613
equations governing steady two-dimensional conducting, solutions for, 16: 20611
hydromagnetic, in transverse magnetic field, 16: 21117 (AD-269326)
in 19-rod test section with boiling and heat transfer, 16: 20593(R) (TID-15637)
mixing cold turbulent liquid jet with boiling, 16: 20616
of conducting fluid along rectangular tube in external magnetic field, equations for steady-state motion, 16: 20599(T) (FTD-TT-62-298)
particle transport on ideal surface at 0.08 slope, 16: 20594 (USNRDL-TR-436)
perturbation modes of plane, uniform, magnetohydrodynamic, 16: 21160
properties of air-water systems with vortex cylindrical and annular, 16: 20597(T,R) (EURAEC-144)
properties of balanced reverse folded, analytical study, 16: 20595 (XDC-60-1-158)
two-phase systems through apertures, 16: 20615
FLUID FLOW (LAMINAR)
boundary layer transition on flat plate, equipment and measurements of,

16: 20614
heat transfer by free and forced convection in vertical, 16: 20602
FLUID PROPELLANTS
properties and storage in space, bibliography, 16: 21845 (AD-266034)
FLUIDS
electric conductivity measurement from heat transfer in magnetic field, 16: 20607
thermal conductivity, correlation function calculation, 16: 21198
FLUORIDE VOLATILITY PROCESSES
corrosion in, 16: 20041(R) (BMI-1574(Del.))
corrosion of INOR-8 instrument line in hydrofluorinator of volatility pilot plant, 16: 20538 (ORNL-TM-186)
development, 16: 20298(R) (ANL-6477(p.106-54))
development for separation of uranium from graphite fuel, 16: 20042(R) (BNL-696)
FLUORINE
determination by activation with charged particles, 16: 20321 (NP-11608)
electron elastic scattering cross sections at 0 to 15 ev, 16: 21202
neutron reactions, evidence of direct processes in, 16: 21549
FLUORINE IONS
electron photodetachment cross sections, 16: 21202
FLUORINE ISOTOPES F-18
energy level lifetimes, 16: 21443
energy levels and dipole gamma spectra, 16: 21452
energy levels and wave functions, 16: 21501
nucleon pairing forces in, non-canonical transformation for calculation, 16: 21509
production in reactions (F^{19},F^{18}) on nuclei up to 43 Mev, 16: 21428
FLUORINE ISOTOPES F-19
energy levels and wave functions, 16: 21501
energy levels, asymmetric-core collective model for, 16: 21459
fluorine isotope reactions (F^{19},F^{18}) up to 43 Mev, 16: 21428
gamma spectra, 16: 20628 (ANL-6499)
meson (μ) capture, hyperfine effect in, 16: 21400
nitrogen nucleus reactions (nitrogen-14,p) at 21.4 to 27.4, angular distributions from, 16: 21625
nuclear resonance fluorescence at 110 kev, 16: 21443
proton reactions (p,pn) at 20 to 155 Mev, excitation functions for, 16: 21484
reactions (F^{19},F^{18}) on nuclei up to 43 Mev, 16: 21428
FLUORINE ISOTOPES F-21
energy levels, 16: 21627
FLUOROCARBONS
preparation and purification, 16: 20042(R) (BNL-696)
FOOD
analysis of whole chicken by neutron activation, 16: 20337
contamination by fall-out, countermeasures, 16: 20124
contamination of sea, review, 16: 20082
radiation effects on enzyme activity in meats, 16: 20915
radiation processing, effects on control of spoilage by *Clostridium botulinum*, 16: 20914
radioactivity effects in humans, 16: 20229
radiological monitoring, 1961, 16: 20905
FORMATES
radioinduced oxidation, effects of catalase, 16: 20485
FORMIC ACID
carbon-13 effects on dehydration by concentrated sulfuric acid, 16: 20398
FOWLS
cesium-134, iodine-131 and strontium-89 deposition in eggs, 16: 20109
FRANCE
fall-out monitoring, 1951-1962, 16: 20887
FRANCIUM IONS
exchange on natural and synthetic exchangers, 16: 20356 (JÜL-32-RC)
FREE RADICALS
radioinduced in desoxyribonucleic acid, 16: 20195
radioinduced production in benzene–carbon tetrachloride systems, 16: 20510
FREQUENCY ANALYZERS
design, evaluation of system for complex testing, 16: 21118 (AEEW-M-220)
FROGS
cataract development in, from wounds after x irradiation, 16: 20200
radiation effects on tissues, effects of skin gland secretion on permeability to vital stains, 16: 20157(T)
FRUCTOSE
sorption by rat intestine, effects of thorium ions, 16: 20115
FUEL CELLS
operation of regenerative lithium hydride, 16: 20301(R) (ANL-6477 (p.204-16))
FUSED SALT–LIQUID METAL SYSTEMS
mass transfer and mixing in columns, 16: 20042(R) (BNL-696)

G

GADOLINIUM
paramagnetic resonance in alloys and intermetallic compounds, 16: 21192
GADOLINIUM ISOTOPES
nuclear gyromagnetic ratios and quadrupole moments, 16: 21446
GADOLINIUM ISOTOPES Gd-150
energy levels, 16: 21396
GADOLINIUM ISOTOPES Gd-154
energy levels, g values of first excited states, 16: 21505
gamma spectra, angular correlations, 16: 21446
gamma spectra, E2 emission parameters, 16: 21444
GADOLINIUM ISOTOPES Gd-155
gamma E1 spectra and half lives, 16: 21458
gamma spectra, E2 emission parameters, 16: 21444
GADOLINIUM ISOTOPES Gd-156
energy levels, 16: 21506
energy levels, g values of first excited states, 16: 21505
gamma spectra, E2 emission parameters, 16: 21444
GADOLINIUM ISOTOPES Gd-157
gamma spectra, E2 emission parameters, 16: 21444
GADOLINIUM ISOTOPES Gd-158
gamma spectra, E2 emission parameters, 16: 21444
neutron capture cross sections, 16: 20302(R) (ANL-6477(p.217-23))
GADOLINIUM ISOTOPES Gd-160
gamma spectra, E2 emission parameters, 16: 21444
GAGES
development for heat transfer measurements, 16: 20589 (AFCRL-942)
GALACTOSE
sorption by rat intestine, effects of thorium ions, 16: 20115
GALENAS
lead isotope ratios in Indian, for age estimation, 16: 20843
GALLIUM
determination as trace in standard rocks G-1 and W-1, spectrographic, 16: 20831
determination of Fermi surfaces, 16: 21010(R) (AD-264878)
GALLIUM ARSENIDES
crystal structure, 16: 20380
GALLIUM COMPLEXES
with 3-cyanopentane-2,4-dione, stretching frequency of cyano group in, 16: 20421
GALLIUM ISOTOPES Ga-73
yield from neutron fission of uranium-235, 16: 21347 (AWRE-0-58/61)
GAMMA DECAY
classes of quadrupole gamma transitions, 16: 21376
effects of residual nucleonic interactions, 16: 21432
magnitude of dipolar and quadrupolar, 16: 21363(T) (UCRL-Trans-822(L))
GAMMA RADIATION
attenuation by lead, 16: 21697
attenuation in two-legged 11-in. rectangular concrete duct, 16: 21692 (NP-11657)
biological effects on oxidative phosphorylation in liver homogenates, in rats, 16: 20286
biological effects on serum protein levels in rats, 16: 20287
biological effects of low whole-body doses on healing of burns and wounds in rats, 16: 20289
biological effects on hemoglobin oxidation sensitivity in rat, 16: 20196
biological effects on hemoglobin formation in chicken, 16: 20260
carcinogenic effects on ovaries of mice, frequency of tumor occurrence, 16: 20168

chemical effects on polyvinyl acetate, dependence on linear energy transfer, 16: 20501
circular polarization measurement by pair production, 16: 21265 (NP-11600)
detection and measurement using thermoluminescence of lithium fluoride, 16: 21171
detection and measurement, performance of scintillation spectrometer, 16: 20628 (ANL-6499)
detection and measurement, sensitivity of Geiger-Mueller counter for, 16: 20656
detection and measurement using thallium-activated sodium iodide scintillators, 16: 20713
detection and measurement, from decay of 0.1- to 10-nsec nuclear state, 16: 21440
detection and measurement, from decay of short-lived nuclear states, 16: 21441
detection and measurement of resonance fluorescence from decay of short-lived nuclear states, 16: 21442
distribution and leakage in Osaka hot laboratory, 16: 20881
dosage determinations by detector using radioinduced polymerization, 16: 20857(R) (AD-265757)
dosimetry, electrochemical method for, 16: 20880(T,P) (CEA-tr-R-1572)
effects on germination and survival of seed, 16: 20167
effects on sexual hormones of the rat, protective effects of testosterone and estradiol, 16: 20183
effects on sorptive properties of tissues, 16: 20157(T)
emission of EO in 2+ → 2+ transitions, probabilities, 16: 21445
emission of E2, by Coulomb-excited nuclear levels, 16: 21444
field control by film radiography, 16: 20088
field positioning with photographic film techniques, 16: 20087
genetic effects in *Sitophilus sasakii*, 16: 20159
genetic effects on potatoes, 16: 20177
giant resonance behavior, 16: 21455
interactions with protons at 725 and 900 Mev, angular distributions, 16: 21311
internal conversion, nuclear structure effects, 16: 21449
mass absorption coefficients in concrete at 0.14 to 1.32 Mev, 16: 21694
nuclear reactions involving continuum states, 16: 21451
polarization and production in proton scattering by neon-20, 16: 21632
production in nuclear reactions (p,γ), resonance effects, 16: 21452
production in nuclear reactions (n,γ), resonance effects, 16: 21454
production in nuclear reactions of heavy ions, nuclear models for, 16: 21457
production in proton scattering by carbon-12, angular correlations in, 16: 21468
reflection and transmission of scattered, Monte Carlo calculations for concrete, 16: 21693 (NP-11819)
scattering by nuclei, properties of giant resonances, 16: 21456
sorption coefficients in 6 materials at 0.14 to 2.76 Mev, 16: 21695
spectra from nuclear reactions at high energies, 16: 21389

GAMMA SHIELDING
properties of concrete for, 16: 21694
radiation damage of glass window in hot cave, 16: 21097

GAMMA SOURCES
design of cobalt-60, for whole-body irradiation, 16: 20078

GAMMA SPECTRA
angular correlations of nuclear, 16: 21446
detection and measurement of delayed-coincidence, by pulsed-beam methods, 16: 21435
Mössbauer, use to study nuclear properties, 16: 21447
production in Brookhaven Alternating Gradient Synchrotron proton beam at 30° and 30 Bev, 16: 21650 (NP-11624)
production of nuclear E3 and E4, by electron excitation, 16: 21450
statistical analysis, 16: 20628 (ANL-6499)
transition probabilities for E1 emission from odd-A nuclei in rare earth region, 16: 21458
uses of resonance fluorescence in measurement of excited-state magnetic moments, 16: 21448

GAMMA SPECTROMETERS
calibration of scintillation type, absolute, 16: 20655
design of devices for processing data from, 16: 20771
performance with scintillation detector, 16: 20628 (ANL-6499)

GAMMA SPECTROSCOPY
Compton effect compensation in, 16: 20673
development of scintillation techniques for measurement of internal conversion coefficients by, 16: 21134 (TID-15639)

GAS ANALYZERS
design and characteristics for detecting and controlling processes, 16: 20695(P)

GAS COOLED REACTOR EXPERIMENT
fuel element processing, 16: 20537(R) (ORNL-TM-177)

GAS COOLED REACTORS
control rod drive with means for holding rods in shutdown position, 16: 21773(P)
coolant flow, electric field effects on, 16: 20603
coolant flow to hot box, appliance for control, 16: 21750(P)
cooling duct support device, 16: 21781(P)
design of high temperature, for ship propulsion, 16: 21826
design of liquid-moderated, 16: 21768(P)
design with facile access to core for repairs, 16: 21745(P)
development, 16: 20041(R) (BMI-1574(Del.))
device for fuel element support and coolant flow control in, 16: 21785(P)
fuel charging and discharging system, 16: 21774(P)
fuel element design with sleeve, 16: 21777(P)
pressure vessel design for reduced thickness, 16: 21784(P)
refueling machine design for use during operation, 16: 21748(P)
refueling machine design for use during operation, 16: 21754(P)
shield design with shielded coolant passages, internal, 16: 21747(P)
shield plug design for access tube, 16: 21758(P)
shutdown device using balls, 16: 21755(P)
shutdown device using balls, 16: 21756(P)

GAS FLOW
electric field effects on slightly ionized, 16: 20603

GAS FLOW (TURBULENT)
heat transfer and resistance in channels with axial pressure gradients, 16: 20606
heat transfer between parallel walls with unequal heat fluxes, 16: 20604

GAS–LIQUID SYSTEMS
phase transitions, interpretation of random-phase-approximation instabilities as, 16: 21149
phase transitions, interpretation of random-phase-approximation instabilities as, 16: 21148

GASEOUS DIFFUSION PROCESS
theory of uranium-232 stripping from isotope mixtures, 16: 20924 (TID-15054)

GASEOUS IONS
recombination of electrons with atomic, collisional-radiative processes in plasma, 16: 21683

GASES
analysis for short-lived fission products, device, 16: 20692(P)
diffusion and viscosity of mixtures of polar, model for calculation, 16: 20414
diffusion in capillaries, pressure effects, 16: 21141(T) (AEC-tr-5063)
diffusion in three-component, 16: 20305(R) (UCRL-10023)
effects on alpha particle ionization of argon, 16: 21136 (TID-15708)
electron and ion saturation currents in weakly ionized, at high pressures, 16: 21686
electron drift velocities in, diffusion-induced errors in, 16: 21154
Hall and ion slip effects in nonuniform, 16: 21119 (AFBSD-TR-61-80)
magnetic and thermodynamic properties of charged, at 0°K, 16: 21216
particle deposition from, conference, 16: 21224
shock wave properties in variable-conductivity, 16: 21178
thermodynamic properties of ionized at 273 to 51,000°K, 16: 20351 (ARL-191)
transport properties of partially ionized, in magnetic fields, 16: 21682
vibrational relaxation, effects of finite lengths of exciting pulse, 16: 20406
viscosity coefficients of quantum, 16: 21167

GASTROINTESTINAL TRACT
hemorrhage localization with iodine-131, 16: 20058
thyroid uptake of iodine-131 in patients with diseases, 16: 20100

GEIGER-MUELLER TUBES
construction and operating characteristics of flexible, 16: 20740

development for high-temperature operation, 16: 20741
sensitivity for gamma and x rays, 16: 20656
GENETICS
radioinduced heritable mutations in rice, 16: 20180
radioinduced mutations in Drosophila, 16: 20175
radioinduced mutations in Drosophila, 16: 20176
radioinduced mutations in sweet potatoes, 16: 20178
radioinduced somatic mutations in potatoes, 16: 20177
GEOMAGNETIC FIELDS
characteristics, 16: 20234
fluctuations in, effects on Van-Allen-belt particles, 16: 21245
interactions with neutral, ionized solar streams, 16: 21246
studies by Explorer XII, data summary, 16: 20851
GEOMAGNETIC STORMS
analysis, for information on energies of solar origin, 16: 20231
geomagnetic field effects, 16: 20234
ionospheric effects of sudden commencements, 16: 21233
preliminary reverse impulse in suddenly commencing, 16: 21229
sudden commencements, effects of magnitudes on rise times, 16: 21230
GEOPHYSICS
summary of experiments related to nuclear explosion blackout, 16: 20814 (NP-11603)
GERMANIUM
alloying effects on nuclear spin-lattice relaxation of aluminum at 0.37 to 1.2°K, 16: 21184
crystal structure, 16: 20380
radioinduced recombination and trapping centers in antimony- and arsenic-doped, annealing, 16: 21187
separation from arsenic-77, 16: 20474(T) (CEA-tr-R-1476)
GERMANY
fall-out monitoring in Germany, 1953-61, 16: 20128
fall-out monitoring, 1961 atmospheric, 16: 20846
laws covering disposal of radioactive wastes, 16: 21864
GERMANY (PRUSSIA)
radioactivity of lower Silesian copper ores, 16: 20847
GLASS
effects of intense electromagnetic radiation on, 16: 21087(R) (AFOSR-2483)
radiation damage of shielding window in hot cave, 16: 21097
radiation effects on metal oxide films on heat resistant, 16: 21108
scintillation efficiency of cerium-activated, for neutron detection, 16: 20716
thermal radiation shielding by window, 16: 20860 (AFSWP-792)
GLAUCONITES
radioactivity, from Pakistan, 16: 20849
GLOW DISCHARGES
penetration into gap, 16: 21685
GLUCOSE
radiation effects on urinary excretion, whole-body exposure, 16: 20209
sorption by rat intestine, effects of thorium ions, 16: 20115
GLYCEROL
protective effect against radiation in T1 phages, 16: 20294
GOLD
proton reactions at 154 Mev, energy spectra of deuterons, protons, and tritons from, 16: 21488
proton reactions (p,xn) at 40 to 155 Mev, excitation functions of mercury isotopes from, 16: 21485
GOLD (COLLOIDAL)
therapeutic use of radioactive, in lung cancer, 16: 20099
GOLD ISOTOPES Au-197
isomeric chemical shifts, theory, 16: 20305(R) (UCRL-10023)
photon scattering at 4 to 24 Mev, cross sections for inelastic, 16: 21641
proton reactions (p,pn) at 20 to 155 Mev, excitation functions for, 16: 21484
GOLD ISOTOPES Au-198
decay, polarization of electrons in beta, 16: 21614
distribution in human body during radiotherapy of rheumatoid arthritis, 16: 20083
effects on ovarian carcinomas, 16: 20141
GOLD ISOTOPES Au-199
decay, L-Auger yields in, 16: 21359 (TID-15692)
GOLD-MANGANESE ALLOYS
magnetic structure near 50:50 composition, 16: 21213
GONADAL HORMONES
effects on hypophysectomized normal rats exposed to x radiation, 16: 20185
radiation effects in rats, protective effects of testosterone and estradiol, 16: 20183
GONADS
effects of irradiation on ovary grafts in eyes of mice, 16: 20139
effects of irradiation of lower abdomen on reproductive function of women, 16: 20265
effects of whole-body irradiation on male mouse, protective effects of unsaturated fatty acid esters against, 16: 20285
histological modifications induced by salivary gland irradiation, 16: 20216
histological modifications induced by irradiation of salivary glands, 16: 20217
radiation dose from dental x-ray examinations, 16: 20884
radiation effects on embryo testis, protective effects of chemicals against, 16: 20186
radiation effects in female white mice, evaluation of methods for determining, 16: 20288
radioinduced tumors in, effects of single gamma dose on frequency of occurrence, 16: 20168
radiotherapy of ovarian carcinomas with gold-198, 16: 20141
GONIOMETERS
development for pole figure determination by reflection method, 16: 21017 (AE-68)
GRANITES
analysis for major and minor constituents, data tabulation, 16: 20833
analysis of G-1 for tantalum, activation and x-ray fluorescence, 16: 20832
GRAPHITE
elastic and thermal properties, 16: 21038(R) (NP-11665)
emissivity at high temperatures, spectral and total normal, 16: 21042 (WAL-TR-851.2/1)
gamma absorption coefficients at 0.14 to 2.76 Mev, 16: 21695
growth from nickel–carbon melts, dendritic, 16: 21066
neutron scattering law, 16: 21331 (AERE-R-4019)
oxygenated complexes on surface of freshly cleaved, synthesis and functional analysis, 16: 20387
properties for use in vacuum insulation to 4000°F, 16: 20590 (ASD-TDR-62-88)
radiation effects, 16: 20042(R) (BNL-696)
radiographic analysis, methods for, 16: 20809
sorptive properties for iodine at high temperatures, 16: 20042(R) (BNL-696)
GRAPHITE MODERATED REACTORS
control rod drive with means for holding rods in shutdown position, 16: 21773(P)
design with facile access to core for repairs, 16: 21745(P)
device for fuel element support and coolant flow control in, 16: 21785(P)
fuel charging and discharging system, 16: 21774(P)
moderator design for stabilized lattice spacing, 16: 21769(P)
moderator design for sealed cooling ducts, 16: 21760(P)
shield design with shielded coolant passages, internal, 16: 21747(P)
GRAPHITE–URANIUM OXIDE SYSTEMS
separation from iron in combustion ash, 16: 20537(R) (ORNL-TM-177)
GRASS
radioisotope content in Germany, 1953-61, 16: 20128
GRAVITATION
quantization in general relativity, 16: 21144
wave propagation from high-altitude explosions, 16: 20838
wave propagation in atmosphere, model for, 16: 20837
wave properties from high-altitude explosions, 16: 20839
wave solutions in general relativity, 16: 21207
GREENLAND
rocks from eastern, potassium-argon ages, 16: 20845
GROUND
motion measurements in Project Gnome, review, 16: 20872 (PNE-128F)
GROUND WATERS
analysis of dolomite aquifer porosity by tracer methods, 16: 20840

monitoring, 1961, 16: 20906
monitoring, 1961 and 1962, 16: 20907
radiological monitoring, 1961, 16: 20905
GUINEA PIGS
mortality in short-duration overpressures, 16: 20864(R) (DASA-1242)
radiation effects on anaphylaxis in, 16: 20252

H

HAFNIUM
neutron capture at thermal energies, metastable isotope production in, 16: 21395
separation from zirconium by solvent extraction from hydrochloric acid and nitric acid solutions, 16: 20545
sorption of hydrogen by, comparision of reaction kinetics of zirconium, 16: 21064
HAFNIUM FLUORIDES
heat of formation, 16: 20299(R) (ANL-6477(p.155-67))
HAFNIUM ISOTOPES
nuclear gyromagnetic ratios and quadrupole moments, 16: 21446
HAFNIUM ISOTOPES Hf-173
decay schemes, 16: 20305(R) (UCRL-10025)
HAFNIUM ISOTOPES Hf-176
gamma spectra, E2 emission parameters, 16: 21444
HAFNIUM ISOTOPES Hf-177
energy levels at 113 and 321 kev, lifetimes, 16: 21434
gamma E1 spectra and half lives, 16: 21458
gamma spectra, E2 emission parameters, 16: 21444
HAFNIUM ISOTOPES Hf-178
decay scheme, 16: 21395
energy levels, determination from neutron-induced gamma radiation spectra, 16: 21125(R) (ANL-6517)
gamma spectra, EO transition probabilities, 16: 21445
gamma spectra, E2 emission parameters, 16: 21444
production and decay of metastable, 16: 21395
HAFNIUM ISOTOPES Hf-179
decay scheme, 16: 21395
gamma spectra, E2 emission parameters, 16: 21444
production and decay of metastable, 16: 21395
HAFNIUM ISOTOPES Hf-180
decay scheme, 16: 21395
gamma spectra, E2 emission parameters, 16: 21444
production and decay of metastable, 16: 21395
HAFNIUM–MOLYBDENUM ALLOYS
phase studies of rhenium containing, 16: 21036(R) (NMI-9235)
HAFNIUM–RHENIUM ALLOYS
corrosion rates at 1000°C, 16: 20971(R) (AD-266150)
phase studies of molybdenum containing, 16: 21036(R) (NMI-9235)
HAFNIUM–TITANIUM ALLOYS
phase studies and tensile properties, 16: 21058
HAIR
analysis for arsenic, activation, 16: 20344
radiation effects, protective effects of serotonin against, 16: 20162
HALDEN BOILING REACTOR
development review and research programs survey, 16: 21830
kinetics, experiments with first fuel charge, 16: 21813 (HPR-21)
HANDBOOKS AND MANUALS
radioactivity procedures, clinical and biological, 16: 20904
HANDS
radiation burns, treatment, 16: 20136
HANFORD AREA (WASH.)
monitoring of environs, 1960 and 1961, 16: 20905
radiological monitoring, 1961, 16: 20868 (HW-71999)
HANFORD PRODUCTION REACTORS (K)
fuel elements, criticality limits, 16: 20867 (HW-70351(Rev.))
HARWELL SYNCHROTRON
beams, design of external proton, 16: 21649 (NIRL/R/12)
HEALTH PHYSICS
book: *Dosimetric and Special Technological Rules for Nuclear Power*, 16: 20903
summary of New Zealand radiation laboratory activities, 16: 20866 (DXRL-AR/12)
HEART
cardiac catheterization, radiation dose received by bone marrow during, 16: 20888
phosphorus metabolism, effects of exercise and age, tracer study, 16: 20091
radiation dose received in cardiac catheterizations and angio cardiograms, 16: 20089
HEART DISEASES
effects on potassium and sodium metabolism by erythrocytes, 16: 20101
thyroid uptake of iodine-131, in patients with, 16: 20100
HEAT EXCHANGERS
duct design, coaxial valved, 16: 20621(P)
HEAT TRANSFER
air-channel, in turbulent flow with axial pressure gradient, 16: 20606
between two walls with unequal heat fluxes, by turbulent gas flow, 16: 20604
burnout heat flux sustained by boiling water, effects of ultrasonic vibrations, 16: 20591(R) (ATL-A-113)
burnout in boiling water, effects of induced vortices, 16: 20598(T) (EURAEC-146)
burnout in 19-rod test section with boiling fluid flow, 16: 20593(R) (TID-15637)
burnout, Savannah River Lab data compilation, 16: 21810(R) (DP-725)
calculation for boiling reactors, computer code, 16: 20592(R) (EURAEC-264)
calculation in melting solids, 16: 20610
conference, Univ. of Washington, June 1962, 16: 20613
convection effects on forced, in laminar vertical flow, 16: 20602
from cooling fin of heat exchanger, optimum geometry for, 16: 20612
in boiling reactors, effects of single vortex, 16: 20596(T,R) (EURAEC-33)
measurement, development of gage for, 16: 20589 (AFCRL-942)
mixing cold turbulent liquid jet with boiling liquid stream, 16: 20616
theory of radiation magnetogasdynamics, 16: 21124 (AFOSR-2674)
through evacuated insulation materials, mechanisms, 16: 20590 (ASD-TDR-62-88)
HEATERS
design for continuously heating 0.2 pounds per second of clean air to 3100°F, 16: 20560 (DC-59-6-253)
design of gas dynamic type for continuously heating 10 pounds per second of clean air to 3500°F, 16: 20559 (DC-59-5-41)
HEAVY WATER REACTORS
coolant loss, pump seal evaluation, 16: 20564 (DP-666)
design of boiling, 16: 21838(P)
design of gas-cooled, 16: 21768(P)
design of steam-cooled pressure tube, 16: 21757(P)
development of natural uranium fueled, 16: 21810(R) (DP-725)
HELIUM
electron scattering cross sections, 16: 21121 (AFCRL-1062-I)
ionization by electrons at 150 to 550 Mev, 16: 21288
ionization energy for 1 ^1S, 2 ^1S, and 2 ^3S states, 16: 21199
isotopic composition of primary cosmic-ray, 16: 21130(R) (NP-11643)
proton scattering near 100 kev, ionization cross sections, 16: 21218
spectra, excited by alpha and electron impacts in pure, 16: 21147
stopping in hydrogen, 16: 21628
HELIUM ION BEAMS (He-3)
detection and measurement, semiconductor detector systems for, 16: 20746
HELIUM IONS
lifetime of metastable state, beam apparatus for measuring, 16: 21129(R) (NP-11640)
HELIUM ISOTOPES He-3
meson (μ^-) and (π^-) capture, nuclear matrix element from, 16: 21384
nuclear matrix elements, 16: 21384
performance in aligned-nuclei gyroscopes, 16: 20654
reactions (helium-3, $p\gamma$) with boron-10 at 4.5 Mev, angular correlations in, 16: 21568
reactions (helium-3, $\alpha\gamma$) with carbon-13 at 4.50 Mev, angular correlations in, 16: 21571
reactions (helium-3,n) with carbon-13 and -14 at 1.6 to 3.4 Mev, angular distributions and yields from, 16: 21595
reactions (helium-3, n) with carbon-12 at 1.8 to 5.3 Mev, angular distribu-

tions, cross sections, and yields, 16: 21551
reactions with tritium at 3.23 Mev, neutron production in, 16: 21573
scattering by nuclei at 29 Mev, optical model analysis, 16: 21538
HELIUM ISOTOPES He-4
structure from deuteron capture by deuterons, 16: 21274
HELIUM–XENON SYSTEMS
ionization by electrons at 150 to 550 Mev, 16: 21288
HEMATOPOIETIC SYSTEM
radiation effects on function, 16: 20156(T)
HEMINS
oxidation and reduction of iron in, by ultraviolet radiation exposure, 16: 20146
HEMOGLOBIN
effects of embryo irradiation, in chicken, 16: 20260
radiation sickness effects on oxidation sensitivity to nitrite, in rat, 16: 20196
HEMORRHAGE
localization of gastrointestinal, with iodine-131, 16: 20058
HEXANE
boiling from mercury surface, nucleate, 16: 20617
boiling, hydrodynamic model for nucleate pool, 16: 20605
determination, chromatographic, 16: 20525(R) (MCW-1472)
radiolysis, effects of benzene on, 16: 20512
HIBERNATION
radiosensitivity effects on animal skin, 16: 20213
HIGH-ALTITUDE EXPLOSIONS
acoustic-gravity wave propagation from, 16: 20838
acoustic-gravity wave properties from, 16: 20839
detection and identification, 16: 20854
detection and identification, 16: 20855
radiation effects, 16: 20814 (NP-11603)
HIGH-PRESSURE SYSTEMS
review of techniques and uses, 16: 21222
HIROSHIMA
lung cancer incidence in atomic bomb survivors, 16: 20266
HOISTS
design of reactor refueling, with means for connection of thermocouple leads on fuel elements, 16: 21753(P)
HOLMIUM
alpha and carbon-12 reactions, gamma distributions from, 16: 21457
HOLMIUM ISOTOPES
alpha decay, 16: 20305(R) (UCRL-10023)
nuclear gyromagnetic ratios and quadrupole moments, 16: 21446
HOLMIUM ISOTOPES Ho-163
nuclear spin, 16: 20305(R) (UCRL-10023)
HOLMIUM ISOTOPES Ho-165
gamma spectra, E2 emission parameters, 16: 21444
spectra, angular momentum quantum number and hyperfine structure splitting, 16: 21379
HOLMIUM ISOTOPES Ho-166
decay, polarization of electrons in beta, 16: 21614
HOMOGENEOUS REACTORS
control rod efficiency, flux dosting as measurement in arbitrary configuration, 16: 21740
design and characteristics of closed-cycle water-boiler, 16: 21786(P)
hazards summary for AGN-201, 16: 20862 (ANL-6510)
HUMIC ACIDS
dissociation constants, 16: 20462
sorptive properties for calcium and cerium, 16: 20461
HYDRAULIC FLUIDS
shear transmission, 16: 20557 (AD-269396)
HYDRAZYL, DIPHENYLPICRYL-
radiolysis in organic solvents, phase effects, 16: 20511
HYDRIDES
electron scattering at 41.4 Mev, cross sections, 16: 21640
HYDROCARBONS
fractional distillation, irradiation for producing stable distillates, 16: 20921(P)
labeling with tritium, evaluation of catalysts for, 16: 20490
radioinduced ionic reactions in presence of noble gas, 16: 20524(P)
HYDROCHLORIC ACID
corrosive effects on alloys and metals in chemical plants, 16: 20983
proton paramagnetic resonance in aqueous solutions, 16: 20464
HYDROCHLORIC ACID (LABELED)
isotope exchange with decuborane, 16: 20397
HYDRODYNAMICS
shock fronts in two-dimensional unsteady flow, 16: 21210
HYDROFLUORIC ACID
corrosive effects on INOR-8 in volatility pilot plant, 16: 20538 (ORNL-TM-186)
HYDROFLUORIC ACID–HYDROGEN PEROXIDE SYSTEMS
corrosive effects on Monel, 16: 20534(R) (IDO-14574)
HYDROFLUORIC ACID–NITROGEN OXIDE SYSTEMS
chemical properties, 16: 20042(R) (BNL-696)
HYDROGEN
absorption by Zircaloy-2 up to 400°C, effects of stresses, 16: 20985
detection in sodium, design of apparatus for continuous, 16: 20320 (NAA-SR-6986)
diffusion in alpha-delta Zircaloy-2, mechanism, 16: 21075
diffusion in oxide films on zirconium at 200 to 700°C, 16: 21035 (NAA-SR-6267)
dissociation energies, 16: 20042(R) (BNL-696)
effects on radiation effects on embryo intestine and testis, 16: 20186
electron capture from atomic, by protons, 16: 21200
electron scattering cross sections, 16: 21121 (AFCRL-1062-I)
equilibrium attainment after strong shock, 16: 21666 (RISO-35)
equilibrium properties at 5000 to 20000°K, 16: 21177
exchange between deuterium and water vapor, kinetics of, 16: 20923 (NP-11789)
exchange with deuterium on chromium, titanium, and vanadium sesquioxides, 16: 20433
ion exchange equilibria in system with cesium, 16: 20457
ion exchange equilibria cesium rate of movement in chromatographic, 16: 20458
ionization by electrons at 150 to 550 Mev, 16: 21288
meson (π^-) capture in, internally produced electron pairs from, 16: 21315
pickup in zirconium oxide corrosion product, 16: 20979 (HW-71958-RD)
polarization in electric field, distortion of atomic orbitals in, 16: 20411
properties in electrothermal rocket-propulsion systems, 16: 21153
proton scattering near 100 kev, ionization cross sections, 16: 21218
radiolysis of aqueous solutions, kinetics and mechanism, 16: 20520
reactions of plasma torch with methane, kinetics and thermodynamics, 16: 20391
reactions with ethyl radicals, effects of vibrational excitations in, 16: 20408
reactions with titanium–zirconium alloys, phase studies, 16: 21072
recombination with oxygen in thorium oxide slurries, catalyst, 16: 20310(P)
sorption by hafnium and zirconium, comparison of reaction kinetics, 16: 21064
stopping power for neutral helium, hydrogen, and neon, 16: 21628
thermal conductivity and viscosity up to 10^4 °K, 16: 21209
HYDROGEN IONS
dissociation in acceleration tube, 16: 21656
ionization energy for 1 ^2S, 2 ^2S, and 2 ^2S states, 16: 21199
HYDROGEN ISOTOPES
exchange kinetics, 16: 20382
exchange kinetics in thiophene, 16: 20383
HYDROGEN PEROXIDES
dissociation and ionization by electron impact, potentials for, 16: 20410
radiolysis of aqueous solutions, kinetics and mechanism, 16: 20520
HYDROGEN–TITANIUM SYSTEMS
phase studies, 16: 21072
HYDROGEN–ZIRCONIUM SYSTEMS
phase studies, 16: 21072
HYDROMAGNETIC WAVES
characteristics in space, 16: 20234
flow in transverse magnetic field, one-dimensional, 16: 21117 (AD-269326)
propagation in plane, uniform fluid flow, 16: 21160
HYDROQUINONE
reactions of krypton-85 clathrates with ferric ions, 16: 20324(R) (TID-15661)

HYPERFRAGMENTS
binding energies, data summary, 16: 21490
binding energy calculations from independent pair model, 16: 21476
properties, 16: 21465
properties of $_{\Lambda}He^{9}$, 16: 21322
HYPERONS
production of Y_1^* in meson (π^-)-proton interactions, 16: 21289
properties, review, 16: 21276
HYPERONS (Λ)
binding energies and potential depths in nuclear matter, 16: 21470
interactions with nucleons, 16: 21465
interactions with nucleons, forces in, 16: 21470
interactions with protons, elastic scattering, 16: 21264 (JINR-D-820)
interactions with mesons (π), resonances in, 16: 21296
parity relative to hyperons (Σ), 16: 21299
HYPERONS (Λ^0)
production amplitudes, resonance with mesons (K^0), 16: 21300
HYPERONS (Σ)
interactions with mesons (π), resonances in, 16: 21296
parity relative to hyperons (Λ), 16: 21299
resonant state with meson (π), parity, 16: 21326
HYPERONS (Σ^-)
interactions in nuclear emulsions, sign of nuclear potential, 16: 21483
HYPERONS (Σ^+)
interactions in nuclear emulsions, sign of nuclear potential, 16: 21483
HYPERONS (Ξ^-)
interactions with protons, resonances from, 16: 21287
HYPERONS ($\bar{\Xi}^0$)
interactions with protons, resonances from, 16: 21287
HYPOCHLORITES
calcium, corrosive effects on alloys and metals in chemical plants, 16: 20983

I

ICE
positron annihilation in, 15-kgauss magnetic field effects, 16: 21175
IMAGE BRIGHTNESS INTENSIFIERS
design and performance of multi-stage electroluminescent, 16: 20726
design for radiation detectors, 16: 20721
design for use with scintillation detectors, 16: 20720
development, 16: 20642 (NP-11663)
use for study of rare decay modes of elementary particles, 16: 20719
IN-PILE LOOPS
development of organic, for Russian IRT-2000 reactor, 16: 21841
INCOMPRESSIBLE FLOW
properties in strong magnetic fields, 16: 20609
slip in entrance region of parallel plate channel, 16: 20620
INDIA
lead isotope ratios in galena from Zangamrajupalle, 16: 20843
INDIAN POINT POWER REACTOR
core assembly physics and zero power tests, 16: 21795 (BAW-163)
INDIUM COMPLEXES
with 3-cyanopentane-2,4-dione, stretching frequency of cyano group in, 16: 20421
INDIUM ISOTOPES In-110
decay schemes, 16: 21381
INDIUM ISOTOPES In-111
separation from cadmium targets after proton irradiation with cyclotron, 16: 20551
INDIUM ISOTOPES In-113
half life, 16: 21405
INDIUM ISOTOPES In-115
decay and half life, 16: 21405
energy levels and E3 and E4 gamma spectra, 16: 21450
energy levels, lifetimes, 16: 21440
gamma excitation to metastable state, 16: 21366
photon scattering at 4 to 24 Mev, cross sections for inelastic, 16: 21641
5-INDOLOL, 3-(2-AMINOETHYL)-
protective effects against x radiation on hair, 16: 20162
INDUSTRIAL HYGIENE
in uranium mines and ore processing plants, 16: 20893
INFECTIONS
effects of irradiation on *Staphylococcus aureus* in rabbits, 16: 20257
effects of radiation sickness on recovery from vaccinia virus, 16: 20270
radiation effects on trypanosomiasis in rats, 16: 20256
radiation effects on lymphocytic choriomeningitis in mice, 16: 20271
radiation effects on lymphocytic choriomeningitis in mice, 16: 20272
INFRARED SPECTROMETERS
development, 16: 21121 (AFCRL-1062-I)
INITIAL ENGINE TEST
development, 16: 21796 (DC-55-6-7)
instrumentation, calibration of nuclear sensors, 16: 20632 (DC-59-6-34)
INSECTS
radioinduced genetic changes in *Sitophilus sasakii*, 16: 20159
radioinduced somatic mutations in meal moth at low doses, 16: 20281
INSTRUMENTATION
development for ETR and MTR studies, 16: 21839(R) (IDO-16760)
development for reactors, 16: 21718(R) (GEMP-72)
development for studies in nuclear physics, limitations and needs, 16: 21605
development of radiation laboratory, 16: 20305(R) (UCRL-10023)
INSTRUMENTS
conference on nuclear, 16: 20757
conference on nuclear, 16: 20706
design, theory of electron, 16: 21269(T) (FTD-TT-61-23)
gyroscope using aligned nuclei, description, 16: 20654
INTERFEROMETERS
development for study of 01 green and red lines in aurora, twilight, and nightglow, 16: 21121 (AFCRL-1062-I)
development of all-sky camera type, 16: 21122 (AFCRL-1062-II)
INTERMEDIATE REACTORS
multiplication constants for bare, 16: 21728 (XDC-60-1-211)
INTERMETALLIC COMPOUNDS
annealing effects on chalcopyrite, 16: 21007 (AD-230373)
INTERNAL CONVERSION
nuclear structure effects, penetration-matrix theory for, 16: 21449
INTESTINE
radiation effects on embryo, protective effects of chemicals against, 16: 20186
sugar sorption by rat, effects of thorium ions, 16: 20115
IODINE
absorption by graphite at high temperatures, 16: 20042(R) (BNL-696)
determination of protein-bound, in human serum by x-ray spectroscopy, 16: 20331
photochemical reactions with isopropyl radicals, 16: 20472(R) (RRL-79)
radiolysis in organic solvents, phase effects, 16: 20511
reactor poisoning, effects on shutdown behavior, 16: 21738
IODINE ISOTOPES I-127
energy levels, 16: 21525
IODINE ISOTOPES I-129
energy levels, 16: 21525
IODINE ISOTOPES I-131
biological half life in thyroid, 16: 20085
content in drinking waters in England, 16: 20126
content in milk in Italy, Oct. to Dec. 1961, 16: 20127
deposition in hen's eggs, 16: 20109
determination in biological materials, radiochemical method, 16: 20050
determination in shore sand and sea silt, gamma-spectrometric, 16: 20323 (PG-Report-312)
determination in tellurium isotopes, radiometric, 16: 20489
diagnostic use in children, possible harmful effects, 16: 20891
gamma emission measurements, 16: 21697
recovery from irradiated materials, survey of development of separation methods, 16: 20500
separation from waste solutions by flocculation, 16: 21862
thyroid levels following radiotherapy of cervix, 16: 20102
uptake by thyroid gland in patients with alimentary and cardiovascular diseases, 16: 20100
IODINE ISOTOPES I-132
energy levels, lifetimes, 16: 21440
separation from neutron-irradiated uranium by fractionated sorption on aluminum oxide, 16: 20544

ION BEAMS
energy resolution improvement in Van de Graaff accelerators, 16: 21642 (AD-267612)
space-charge neutralization using coaxial electron beams, 16: 21152
ION EXCHANGE
developments and uses, review, 16: 20390
ION EXCHANGE MATERIALS
development, 16: 20305(R) (UCRL-10023)
radiation damage, 16: 20537(R) (ORNL-TM-177)
ION EXCHANGE PROCESSES
data interpretation and equipment development in, 16: 20316
ION SOURCES
characteristics of duoplasmatron as, 16: 20649(T) (FTD-TT-62-480)
description of space-charge-neutralized, using coaxial electron beams, 16: 21152
design survey, 16: 20650(T) (NP-tr-894)
propulsion efficiency and ion chamber performance, scale effects on, 16: 21851
IONIZATION
mass spectroscopy of surface, 16: 20305(R) (UCRL-10023)
theory of surface, for application to ion propulsion, 16: 21846 (AD-268695)
IONIZATION CHAMBERS
design and performance for low-level alpha spectrometry, 16: 20735
design and performance of solid-state, 16: 20749
design and performance of guarded-field thimble type, 16: 20686
design for alpha group analysis, 16: 20643 (NP-11691)
design of gamma-compensated, with a-c amplification, 16: 20690(P)
design of solid state space probe, 16: 20240
performance at ambient temperature of, filled with liquid dielectric, 16: 20734
performance, effects of size on cavity ionization, 16: 20657
use of spherical, for beta source activity measurements, 16: 20672
IONOSPHERE
disturbance by geomagnetic storms and solar flares, 16: 21233
electron content and variations in, on magnetically quiet and disturbed days, 16: 21247
solar-flare effects on, role of x rays below 8 Å and Lyman-α rays, 16: 21232
temperature measurements, 16: 21227
IONS
distribution in exosphere, and whistling atmospherics, 16: 21120 (AFCRL-62-294)
physiochemical properties, relations with radius in gaseous, 16: 20365(T) (AEC-tr-4457(p.1-9))
reactions at 0.3 to 3.0 kev, energy distribution of induced electrons, 16: 21346 (ARL-185)
reactions with atoms, 16: 21121 (AFCRL-1062-I)
reactions with nuclei, fragmentation in, 16: 21634
thermodynamic properties at 273 to 51,000°K, 16: 20351 (ARL-191)
IRIDIUM
emission behavior in plasma diodes, 16: 21138 (UCRL-6809)
IRIDIUM ISOTOPES Ir-192
neutron reactions (n,γ), gamma spectra, 16: 21454
IRIDIUM ISOTOPES Ir-194
neutron reactions (n,γ), gamma spectra, 16: 21454
IRIDIUM–SILICON SYSTEMS
heats of formation, 16: 20394
IRIDIUM–TANTALUM ALLOYS
phase studies, 16: 21036(R) (NMI-9235)
IRIDIUM–TUNGSTEN ALLOYS
phase studies, 16: 21036(R) (NMI-9235)
IRON
alpha scattering at 43 Mev, excitation of collective levels by inelastic, 16: 21514
brittle-ductile transition, 16: 21068
content in human serum and muscles, 16: 20098
corrosion by acids and chloride salts in chemical plants, 16: 20983
creep of alpha, incubation effects, 16: 21010(R) (AD-264878)
determination in chicken by neutron activation, 16: 20337
determination in rare earth oxides, spectrographic method for, 16: 20327
deuteron reactions (d, helium-3) at 21.6 Mev, determination of configurations of states by, 16: 21562
diffusion and solubility in beryllium, 16: 21054
gamma absorption coefficients at 0.14 to 2.76 Mev, 16: 21695
in hemins, oxidation and reduction by ultraviolet radiation exposure, 16: 20146
meson (μ) scattering at 298 to 773 Mev/c, 16: 21248
oxidation in carbon dioxide and carbon monoxide mixtures at 700 to 1100°C, 16: 20360 (NYO-10289)
properties as x-ray filter, 16: 20086
radiation damage, 16: 20042(R) (BNL-696)
uptake and distribution in *Ciona intestinalis*, 16: 20119
IRON CARBIDES
decomposition by acids, mechanism, 16: 20377(T) (AEC-tr-5111)
IRON(III) CHLORIDES
etching effects on lithium fluoride crystals, adsorption-locking and Rebinder effect in, 16: 20437
radiolysis in organic solvents, phase effects, 16: 20511
IRON COMPLEXES
ionic bonding and iron-57 Mössbauer resonance in, 16: 20404
spectra, Mössbauer, 16: 20413
with 3-cyanopentane-2,4-dione, stretching frequency of cyano group in, 16: 20421
IRON CYANIDES
formation and properties of uranyl, 16: 20367(T) (AEC-tr-4457(p.69-79))
radiation effects, measurement of amount and composition of radiation products, 16: 20466 (AERE-R-3409)
IRON(II) FLUORIDES
nuclear properties of iron-57 in, study by Mössbauer effect, 16: 21447
IRON(III) IONS
reactions with hydroquinone–krypton-85 clathrates, 16: 20324(R) (TID-15661)
IRON ISOTOPES
nuclear potentials, evidence for distortion, 16: 21565
IRON ISOTOPES Fe-54
proton reactions (p,d) at 22 Mev, angular distributions from, 16: 21563
proton scattering at 2 to 5 Mev, resonances in, 16: 21543
IRON ISOTOPES Fe-56
nuclear magnetic moments of excited states, 16: 21448
proton reactions (p,d), deuteron spectra evidence of nucleus deformation in, 16: 21564
proton reactions (p,α) at 18 Mev, seniority wave function effects on angular distributions and cross sections, 16: 21578
IRON ISOTOPES Fe-57
electric dipole moments, upper limits for longitudinal, 16: 21314
energy level at 14.4 kev, electric quadrupole moment, 16: 21418
gamma hyperfine spectra, Mössbauer analysis, 16: 21446
nuclear properties, study by Mössbauer effect, 16: 21447
proton reactions (p,d), deuteron spectra evidence of nucleus deformation in, 16: 21564
IRON ISOTOPES Fe-58
proton reactions (p,d), deuteron spectra evidence of nucleus deformation in, 16: 21564
IRON ISOTOPES Fe-59
determination in biological materials, radiochemical method, 16: 20658
determination in fish after ingestion, 16: 20059
uptake by blood in irradiated pregnant mice, 16: 20190
IRON–MOLYBDENUM–NICKEL ALLOYS
corrosion by molten fluoride salts, 16: 20974 (BMI-X-198)
IRON NITRATES
hydrolysis of aqueous solutions, acid extraction by amine, 16: 20434
IRON(II) OXIDES
diffusion in polycrystalline magnesium oxide, 16: 20395
IRON(III) OXIDES
nuclear properties of iron-57 in, study by Mössbauer effect, 16: 21447
IRRADIATION FACILITIES
design for grain, 16: 20586(P)
design for liquids, 16: 20920(P)
design of circulating loop for electron irradiation of liquids, 16: 20487
design of water-cooled in-pile, 16: 21737
design of whole-body, 16: 20078
remote control apparatus for loading and unloading reactor channel, 16: 20582(P)

temperature control in cobalt-60 hollow-cylinder source, 16: 20572
ISOTOPES
separation of binary mixtures in tapered columns, 16: 20922 (IFA/DF/15)
ISOTOPIC EXCHANGE
kinetic effects on chemical reactions, 16: 20361 (TID-15788)
ITALY
iodine-131 content of milk, Oct. to Dec. 1961, 16: 20127

J

JAPAN
cesium-137 content in Osaka Bay water, 16: 20123
radioactivities in rain water, dusts, weeds, and sea water in Osaka, 1961, 16: 20121
radioactivities of rain and dusts in July to Sept. 1961, 16: 20129
radioactivity of air-borne dusts in Osaka, fall 1961, 16: 20122
uranium content of sediments, 16: 20844
JOURNAL BEARINGS
analysis of magnetohydrodynamic, using liquid metal lubricant, 16: 20570

K

KETONES
solvent properties of di-isopropyl for protactinium, 16: 20451
KIDNEYS
radiation effects on fluid passage, 16: 20214
KRYPTON
proton scattering near 100 kev, ionization cross sections, 16: 21218
spectra, excited by alpha and electron impacts in pure, 16: 21147
KRYPTON IONS
etching effects at anode-cathode potential of 3500 volts d-c on uranium microstructure, 16: 20953 (HW-73476)
KRYPTON ISOTOPES Kr-85
use in radioinduced polymerization, 16: 20471 (NYO-9485)
use in tracing oxidation-reduction states of metals, 16: 20324(R) (TID-15661)
KRYPTON–NITROGEN SYSTEMS
electric discharge, constriction, volt-ampere characteristics, and volume recombination of the positive column, 16: 21179

L

LABORATORIES
design for post-irradiation examinations at Windscale, 16: 21089 (DPR/INF/265)
design of clean rooms, 16: 20874 (SC-4673(RR))
design of tracer, 16: 20568
LABORATORY FURNITURE
chamber for handling radioactive materials, 16: 20585(P)
LANTHANUM
determination as trace in standard rocks G-1 and W-1, spectrographic, 16: 20831
LANTHANUM ISOTOPES La-140
separation from waste solutions by flocculation, 16: 21862
LANTHANUM OXIDE–URANIUM OXIDE SYSTEMS
crystal structure and phase studies, 16: 20393
LANTHANUM OXIDES
analysis for impurities, spectrographic method for, 16: 20327
LEAD
determination as trace in standard rocks G-1 and W-1, spectrographic, 16: 20831
determination in monazites polarographic, 16: 20325(T) (NP-tr-895)
determination in rare earth oxides, spectrographic method for, 16: 20327
gamma absorption coefficients at 0.14 to 2.76 Mev, 16: 21695
gamma attenuation, 16: 21697
neutron scattering, excitation cross sections in inelastic, 16: 21545
separation from aqueous solutions by cellulose, lignin, oxycellulose, and wood, 16: 20090
LEAD CHLORIDE–POTASSIUM CHLORIDE SYSTEMS
thermal bleaching of chloride centers in, 16: 20415
LEAD COMPOUNDS
quenching effects of lead-2-ethyl hexanoate on liquid scintillators, 16: 21158
LEAD ISOTOPES
ratios in Indian galena, 16: 20843
LEAD ISOTOPES Pb-206
deuteron reactions (d,p) at 8.3 to 15 Mev, Coulomb-distorted angular distribution from, 16: 21580
LEAD ISOTOPES Pb-207
energy levels, lifetimes, 16: 21440
nitrogen nucleus reactions (nitrogen-14, nitrogen-13) at 112 Mev, energy level selection in neutron transfer in, 16: 21536
LEAD ISOTOPES Pb-208
energy levels and E3 and E4 gamma spectra, 16: 21450
energy levels, gamma cascade angular correlations for, 16: 21392
energy levels, verification by gamma-gamma correlations in transitions, 16: 21635
nitrogen nucleus reactions (nitrogen-14, nitrogen-13) at 112 Mev, energy level selection in neutron transfer in, 16: 21536
LEAD OXIDE FILMS
radiation effects on, applied to glass, 16: 21108
LEAD TELLURIDES
fabrication for use in thermoelectric cells, 16: 21110(R) (AD-251485)
LEAKS
detection in cables using radon, 16: 20910(T) (CEA-tr-A-1052)
LEAVES
radioactivity of wild arrowroot, in Japan, 16: 20122
LECTURES
book: *Quantum Theory of Many-Particle Systems*, 16: 21223
on elementary particle physics, 16: 21263 (CERN-62-14)
on fundamental problems in statistical mechanics, 16: 20949
on non-relativistic theory, 16: 21260 (AFOSR-2409)
on relativistic quantum mechanics, 16: 21699 (CERN-62-15)
on S-matrix theory, 16: 21267 (UCRL-9875(Vol.2))
LEUKEMIA
incidence in Nagasaki bomb survivors, 16: 20251
radiation effects on granulocyte peroxydases in, 16: 20161
LEUKOCYTES
effects of nitrogen mustard on metabolism, 16: 20062
effects on antibody formation in rabbits, 16: 20275
LEUKOPENIA
effects of radioinduced, on meningitis, 16: 20094
radioinduced, protective effects of dexamethasone against, 16: 20269
LIFE SPANS
radiation effects on rats, effects of oxygen consumption during irradiation, 16: 20280
LIGHT
effects on photosynthesis in algae, 16: 20238
LIGHT SOURCES
design of casing for nuclear, 16: 20583(P)
operation of three-electrode vacuum spark for continuous spectra from visible to x-ray regions, 16: 20448
LIMESTONE
uranium mineralization in christobalite and tridymite in, 16: 20824
LINEAR ACCELERATORS
beams, handling of NRL Linac, 16: 21130(R) (NP-11643)
dimension corrections for MRC, 16: 21643 (AERE-Memo-G/M-37)
operation and performance of Orsay, 16: 21646(R) (LAL-1010)
operation and performance of Orsay, 16: 21647(R) (LAL-1021)
LINOLEIC ACID, METHYL ESTER
effects on radiation sickness in gonads of male mice, 16: 20285
LIQUID JETS
mixing cold turbulent, with boiling liquid stream, 16: 20616
LIQUIDS
boiling studies, 16: 20313
dispersion in agitated, 16: 20305(R) (UCRL-10023)
irradiation, container fabrication for, 16: 20574
irradiation with electrons, design of circulating loop for, 16: 20487
nuclear magnetization in, due to Overhauser effect, 16: 21357 (RADC-TR-61-132)
separation of immiscible by gravity settling, 16: 20540 (UCRL-10048)
LITHIUM

abundance of lithium-6 in, activation determination, 16: 20318 (IA-690)
determination in rare earth oxides, spectrographic method for, 16: 20327
nitridation at 0 to 365°C, 16: 20456
performance in two-fluid magnetohydrodynamic cells, 16: 21151
LITHIUM BROMIDES
chemical effects on benzophenone free radical, 16: 20455
LITHIUM CHLORIDES
decontamination, design of radiochemical waste evaporator system for, 16: 21861
LITHIUM CHLORIDES (LIQUID)
thermodynamics of nickel in, oxygen equilibrium potential diagram for, 16: 20426
LITHIUM FLUORIDE CRYSTALS
dislocation mechanisms and theory, 16: 21221
dislocations in, adsorption-locking and Rebinder effect, 16: 20437
neutron reflectivity, 16: 20637 (JAERI-1030(Suppl.))
thermoluminescence following gamma and thermal neutron excitation, use in dosimetry, 16: 21171
LITHIUM FLUORIDES
corrosive effects in aqueous solutions on Zircaloy-2, 16: 20977 (CRGM-1082)
scintillation properties at low temperatures, 16: 20707
LITHIUM HYDROXIDES
spectra, infrared-absorption, 16: 20409
LITHIUM HYDROXIDES (LABELED)
spectra, infrared-absorption, 16: 20409
LITHIUM IODIDES
scintillation properties at low temperatures, 16: 20707
LITHIUM IONS
electronic fine structure, 16: 21129(R) (NP-11640)
LITHIUM ISOTOPES Li-6
abundance in lithium, activation determination, 16: 20318 (IA-690)
chemical effects on polyvinyl acetate, dependence on linear energy transfer, 16: 20501
energy levels and dipole gamma spectra, 16: 21452
nuclear models, comparison of cluster and shell, 16: 21429
nuclear structure, neutron-proton interactions in s and d states, 16: 21532
reactions (lithium-6,d) and (lithium-6,t) with lithium-6 and -7 at 6 Mev, 16: 21598
triton reactions (t,d) at 0.9 to 2.0 Mev, cross sections, 16: 21567
LITHIUM ISOTOPES Li-7
alpha reactions (α,γ) at 400 to 950 kev, angular correlations, 16: 21427
alpha reactions (α,n) at 13.5 to 13.9 Mev, angular distributions from, 16: 21602
deuteron reactions (d,p) at 2 to 4 Mev, distorted-wave calculations of cross sections, 16: 21596
lithium nucleus reactions (lithium-6,d) and (lithium-6,t) at 6 Mev, 16: 21598
magnetic resonance in lithium-vanadium bronze, 16: 21123 (AFOSR-1959)
triton reactions (t,α) at 1 to 2 Mev, cross sections, 16: 21570
LITHIUM ISOTOPES Li-8
emission in proton reactions with nuclei at 9 Bev, double, 16: 21415
nuclear magnetic moment, sign, 16: 21419
LITHIUM URANATES
formation in aqueous media, 16: 20385
LIVER
effects of whole-body irradiation on oxidative phosphorylation, in rats, 16: 20286
effects of whole-body irradiation in rat, effects of adrenal hormones, 16: 20247
effects of whole-body irradiation on enzymatic activity of regenerating, in rat, 16: 20255
protective effects against radiation in mice, 16: 20160
radiation effects on alterations in deoxyribonucleic acid from regenerating rat, *in vivo*, 16: 20199
radiation effects on tritium incorporation in, 16: 20221
radiosensitivity of enzymes, 16: 20915
LOS ALAMOS MOLTEN PLUTONIUM REACTOR EXPERIMENTS
design, 16: 21732
LUBRICATION
of extrusion apparatus, 16: 21003(P)
LUMINESCENT DETECTORS
design and performance of radiation-image type, 16: 20733
design and use for high-energy physics experiments, 16: 20722
LUNGS
cancer incidence in Hiroshima survivors, 16: 20266
pulmonary function of various regions, use of xenon-133 to study, 16: 20065
radiation damage, 16: 20228
radiation sickness effects on blood vessels, chronic, 16: 20189
radioinduced carcinoma in bronchial epithelium in rat, 16: 20147
radioinduced carcinoma in alveolar epithelium in rat, 16: 20148
therapy of cancer with radioactive gold (colloidal), 16: 20099
thorium distribution in, following inhalation of thorium chloride, 16: 20876 (UR-605)
LUTETIUM ISOTOPES
nuclear gyromagnetic ratios and quadrupole moments, 16: 21446
LUTETIUM ISOTOPES Lu-172
energy levels, 16: 20305(R) (UCRL-10023)
LUTETIUM ISOTOPES Lu-175
gamma E1 spectra and half lives, 16: 21458
gamma spectra, angular distributions and resonance fluorescence, 16: 21448
gamma spectra, E2 emission parameters, 16: 21444
neutron capture cross sections, 16: 20302(R) (ANL-6477(p.217-23))
nuclear magnetic resonance, 16: 21203
LUTETIUM ISOTOPES Lu-177
gamma E1 spectra and half lives, 16: 21458
LYMPH
effects of whole-body irradiation, in rabbit, 16: 20259
LYMPH DISEASES
tumors induced by urethan in mouse thymus, 16: 20074

M

MAGNESIUM
determination in rare earth oxides, spectrographic method for, 16: 20327
deuteron scattering at 13 Mev, angular distributions from elastic, 16: 21566
thermodynamics in potassium chloride (liquid), oxygen equilibrium potential diagram for, 16: 20426
MAGNESIUM ALLOYS
creep behavior of heat treated, 16: 21076
MAGNESIUM CERIUM NITRATES
spectra of cerium ions in, line widths of emission, 16: 21205
MAGNESIUM CHLORIDE–SODIUM CHLORIDE SYSTEMS
thermodynamic properties fused, 16: 20042(R) (BNL-696)
MAGNESIUM CHLORIDES (LIQUID)
thermodynamics of titanium in, oxygen equilibrium potential diagram for, 16: 20426
MAGNESIUM ISOTOPES Mg-24
deuteron reactions (d,p) at 10 Mev, angular distributions from, 16: 21592
deuteron reactions (d,p) at 15 Mev, angular dependence of proton polarization in, 16: 21597
E1 resonance in, calculations of ground-state correlation effects, 16: 21524
nitrogen nucleus reactions (N^{14},N^{15}), angular distribution and ranges of nitrogen-13, 16: 21416
nitrogen-14 nucleus reactions at 28 Mev, nucleon transfer in, 16: 21575
proton scattering at 10.7 Mev, angular correlations in inelastic, 16: 21561
MAGNESIUM ISOTOPES Mg-25
deuteron reactions (d,p) at 10.8 Mev, polarization in, 16: 21581
energy level properties, 16: 21413
energy levels, asymmetric-core collective model for, 16: 21459
MAGNESIUM ISOTOPES Mg-26
energy levels, evidence for first-excited state at 1.33 ± 0.02 Mev, 16: 21527
proton reactions (p,α), Q-value measurement for, 16: 21615
MAGNESIUM LANTHANUM NITRATES
spectra of cerium and neodymium ions in, line widths of emission, 16: 21205
MAGNESIUM–NEODYMIUM ALLOYS
phase studies, 16: 20372(T) (AEC-tr-4457(p.197-204))

MAGNESIUM NEODYMIUM NITRATES
magnetic and thermal properties at 0.1 to 3°K, 16: 20438
MAGNESIUM OXIDE COMPACTS
thermal expansion at −200 to 0°C, 16: 21057
MAGNESIUM OXIDE CRYSTALS
diffusion of cobalt and ferrous oxide in, 16: 20395
microcrack growth in ascleaved single, 16: 20436
MAGNESIUM–ZINC–ZIRCONIUM ALLOYS
thermal stress in Z.W. 1, 16: 20811(P)
MAGNESIUM–ZIRCONIUM ALLOYS
phase study of zirconium-rich phases, 16: 21044(T) (AEC-tr-5127)
MAGNETIC FIELDS
creation in space, 16: 21234
hydromagnetic flow in transverse, 16: 21117 (AD-269326)
plasma containment by periodic, 16: 21677
plasma containment by d-c, with external forces, 16: 21678
plasma jet interactions with, produced by straight wire, 16: 20619
MAGNETIC MATERIALS
properties, determination by microwaves, 16: 21010(R) (AD-264878)
susceptibilities in Bloch-electron theory, 16: 21176
MAGNETIC PROBES
design of wideband integrator, 16: 20661
MAGNETIC PROPERTIES
nuclear magnetization in liquids due to Overhauser effect, 16: 21357
MAGNETIC RESONANCE
book: *Solid State Physics. XIII.*, 16: 21221
of S-state ions in metals, 16: 21192
MAGNETOHYDRODYNAMIC CELLS
design and performance of two-fluid system, 16: 21151
development, 16: 21847 (AFOSR-2352)
development, 16: 21850(T) (AD-266765)
MAGNETOHYDRODYNAMICS
analysis of Hall and ion slip effects in nonuniform gases, 16: 21119 (AFBSD-TR-61-80)
bibliography, 1953 to 1962, 16: 21660 (AD-271170)
convective heat transfer between flowing fluid and boundary surface, 16: 20607
flow of partially ionized gas, transport equations, 16: 21682
mathematical analysis of pressurized journal bearing, using liquid metal lubricant, 16: 20570
shock wave structure, 16: 21662 (AFSWC-TDR-62-42)
shock wave structure in, 16: 21206
theory of radiation, 16: 21124 (AFOSR-2674)
MAGNETOMETERS
sensing coil signal-to-noise ratios in nuclear, 16: 20682
MAMMALS
strontium saturation of skeleton, 16: 20108
MAMMARY GLAND
effects of whole-body irradiation on tumor incidence in rat, effects of injected tumor fluid, 16: 20253
radiation effects on development, 16: 20170
MAN
effects of irradiation of lower abdomen on reproductive function of women, 16: 20265
environmental requirements in space, 16: 20237
radiation dose arising from medical procedures, 16: 20211
radiation dose from radiologic examinations for congenital heart disease, 16: 20890
radiation effects, review, 16: 20181
radiation effects, review, 16: 20261
radiation injury prophylaxis and therapy, 16: 20242
radiation tolerance criteria in space flight, 16: 20882
MAN (STANDARD)
radiation interactions, heavy primary cosmic, 16: 20239
MANGANESE
determination as trace in standard rocks G-1 and W-1, spectrographic, 16: 20831
determination in chicken by neutron activation, 16: 20337
determination in nuclear steels, neutron activation, 16: 20330
determination in rare earth oxides, spectrographic method for, 16: 20327
MANGANESE ISOTOPES
nuclear potentials, evidence for distortion, 16: 21565
MANGANESE ISOTOPES Mn-52
decay, beta-gamma circular-polarization correlation and isospin conservation in, 16: 21616
MANGANESE ISOTOPES Mn-55
fluorine isotope reactions (F^{19},F^{18}) up to 43 Mev, 16: 21428
nuclear resonance fluorescence at 126 kev, 16: 21443
proton reactions (p,pn) at 20 to 155 Mev, excitation functions for, 16: 21484
proton reactions (p,α) at 18 Mev, seniority wave function effects on angular distributions and cross sections, 16: 21578
MANGANESE ISOTOPES Mn-56
decay, polarization of electrons in beta, 16: 21614
MANGANESE OXIDES
radiation effects on films, on glass, 16: 21108
MARITIME GAS COOLED REACTOR
fuel materials radiation effects studies, 16: 20041(R) (BMI-1574(Del.))
MARITIME PRESSURIZED WATER REACTOR
criticality studies on 4%-enriched uranium dioxide cores, 16: 21257 (BAW-1216)
MARITIME REACTORS
control rod drive with means for holding rods in shutdown position, 16: 21773(P)
design of boiling, 16: 21836(P)
design of gas-cooled high temperatures, 16: 21826
fuel charging and discharging system, 16: 21774(P)
MASS SPECTROMETERS
corrections for tailing in lead isotope analyses, 16: 20843
design with built-in system for automatic processing of output data, 16: 20670
MATERIALS TESTING
determination of materials behavior from true stress-strain relations, 16: 20806 (NAA-SR-6376)
equipment for measuring thermal stresses, 16: 20811(P)
standards for nuclear industry, 16: 21742
MATHEMATICAL TABLES
Clebsch-Gordan coefficients, 16: 21348 (IFA/FT-40)
MATHEMATICS
addition theorems for spherical wave functions, 16: 20946
canonical and Hamiltonian formalism applied to Sturm-Liouville equation, 16: 20942
derivation of Sommerfeld solution for diffraction of plane, scalar wave by half-plane, 16: 20944
discontinuities in integral-transform solutions, 16: 20947
momentum-space vertex function analyticity properties, 16: 20937
research progress under U. S. Army auspices, 1961, 16: 20043(R) (NP-11537)
solution of hyperbolic equations with constant coefficients, 16: 2094
solution of linear differential equations, use of linear programming in, 16: 20932 (UCRL-10110)
solution to transport equation, 16: 21130(R) (NP-11643)
solutions of modified Dirac equation, 16: 21261 (AFOSR-TR-60-172)
stability by Liapunov's direct method, 16: 20948
transfer functions, properties of certain classes, 16: 21219
transport equations, incorporation of error function absorption coefficient in, 16: 21328
two-group diffusion equations for stationary systems, computer numerical solution, 16: 21341
variational principles for problems in hydrodynamic and hydromagnetic stability, 16: 20945
MECHANICAL ENGINEERING
design optimization in, use of computers in, 16: 20555 (AAEC/E-85)
high stress level fatigue theory development, 16: 20805 (ARL-181)
research progress under U. S. Army auspices, 1961, 16: 20043(R) (NP-11537)
tracer applications, survey, 16: 20916
MECHANICS
book: *Fundamental Problems in Statistical Mechanics*, 16: 20949
determination of materials behavior from true stress-strain relations, 16: 20806 (NAA-SR-6376)
MEMORY DEVICES
design of address scaler and temporary memory for a transistorized time-of-flight analyzer, 16: 20763

design of intermediate arithmetic, 16: 20768
design of magnetic, for multi-dimensional selectors, 16: 20774
design of memorizing circuit for long pulses, 16: 20804
MERCHANT VESSELS
nuclear-powered, evaluation of collision-resisting sides, 16: 20573
MERCURY
boiling hexane and water from surface, nucleate, 16: 20617
boiling 2-propanol and water on surfaces, nucleate, 16: 20618
corrosive effects of superheated, on loop materials, 16: 20042(R) (BNL-696)
MERCURY COMPOUNDS
quenching effects of biphenyl on liquid scintillators, 16: 21158
MERCURY ISOTOPES
production by proton reactions with gold, excitation functions for, 16: 21485
MERCURY ISOTOPES Hg-198
gamma spectra, EO transition probabilities, 16: 21445
MERCURY ISOTOPES Hg-199
electron conversion spectra, L-Auger, 16: 21359 (TID-15692)
MERCURY ISOTOPES Hg-203
internal conversion coefficients of K shell, development of gamma scintillation spectrometry for determination, 16: 21134 (TID-15639)
MESIC ATOMS
decay of K^-, relative probabilities of direct and scattering modes, 16: 21534
production and disappearance rates of mu^-, 16: 21174
MESON BEAMS
polarization, 16: 21262 (CERN-62-8)
MESONS
connection between gauge invariance and mass, 16: 21324
cutoff theory perturbation expansion convergence, 16: 21278
decay, spark chamber for observation of rare modes, 16: 20732
detection and measurement, geometric effects on, 16: 20635 (ISS-61/7)
interactions with mesons and nucleons, three-meson (π) resonance in, 16: 21620
photoproduction, computer processing of data on, 16: 20635 (ISS-61/7)
MESONS (η^0)
decay quantum numbers, 16: 21318
MESONS (K)
interactions with emulsion nucleons at 10^{10} to 10^{11} ev, angular distributions, 16: 21308
production of K^0 in meson (π^-)-proton interactions, 16: 21289
MESONS (K^-)
interactions with neutrons at 765 Mev/c, Λ-π resonance in, 16: 21482
interactions with nucleons, partial-wave dispersion relations in, 16: 21299
interactions with protons, $K\Sigma N$ parity, 16: 21326
interactions with deuterons and protons, total cross sections at 630 to 1100 Mev, 16: 21360 (UCRL-10125)
interactions with protons, differential elastic cross sections, 16: 21309
MESONS (K^0)
interactions with protons, elastic scattering, 16: 21264 (JINR-D-820)
production amplitudes, resonance with hyperons (Λ^0), 16: 21300
MESONS (K^+)
interactions with nucleons at 50 to 210 Mev, amplitudes for, 16: 21296
MESONS (μ)
capture by calcium-40 and -44, rates for, 16: 21399
capture by fluorine-19, hyperfine effect in, 16: 21400
decay of bound, from K-shell, 16: 21611
detection using flash tubes, computer technique for, 16: 20679
interactions with protons, six nucleon form factors, 16: 21325
model as excited electrons, 16: 21327
parity, 16: 21320
properties, 16: 21272
reactions with nuclei, capture, 16: 21609
reactions with nuclei, spin-dependence of capture, 16: 21610
MESONS (μ^-)
capture by helium-3, nuclear matrix element from, 16: 21384
reactions (μ^-, $n\nu$) of polarized on sulfur nuclei, angular distributions, 16: 21426
reactions on compounds, atomic capture probabilities, 16: 21174
MESONS (ω^0)
decay quantum numbers, 16: 21318
MESONS (π)
interactions, resonances in, 16: 21296
interactions with nucleons to 100 Bev, effective target masses in, 16: 21271
interactions with hyperons (Λ) and (Σ), resonances in, 16: 21296
interactions with emulsion nucleons at 10^{10} to 10^{11} ev, angular distributions, 16: 21308
properties, 16: 21272
resonant state with hyperon (Σ), parity, 16: 21326
wave functions for systems of four free, 16: 21319
MESONS (π^-)
capture by helium-3, nuclear matrix element from, 16: 21384
capture by hydrogen, internally produced electron pairs from, 16: 21315
capture by protons, neutron emission at 8.9 Mev in, 16: 20683
interaction lengths and elastic scattering in G5 emulsion at 300 Mev, 16: 21406
interactions with protons, strange-particle production in, 16: 21289
interactions with protons at 500 to 940 Mev, polarization, 16: 21323
MESONS (π^0)
photoproduction on protons, polarization of recoil protons, 16: 21311
MESONS (π^+)
interactions with protons at 1.0 Bev, angular distributions for elastic, 16: 21293
positron emission probabilities, 16: 21321
METABOLISM
correlation with resistance to tuberculosis in rabbits, 16: 20068
potassium and sodium, by erythrocytes in patients with cardiac insufficiency, 16: 20101
radiation effects, rate of nervous system in, 16: 20192
METAL COMPACTS
sintering of dense, continuous, 16: 21002(P)
METAL COMPLEXES
solid state reactions and synthesis, 16: 21010(R) (AD-264878)
METAL CRYSTALS
glide elements for hexagonal, determination by asterisms in Laue photographs, 16: 21045(T) (AEC-tr-5138)
preparation and properties of ultra-thin-layered, 16: 21010(R) (AD-264878)
METALLOGRAPHY
surface passivation on reactive metals, 16: 20970(P)
METALLURGY
bibliography on all-metal sandwiches, 16: 20957 (NP-11677)
conference on corrosion, Brookhaven National Lab., May 23 to 25, 1962, 16: 20975 (BNL-728)
production by vacuum metallurgy, 16: 20967
research progress under U. S. Army auspices, 1961, 16: 20043(R) (NP-11537)
research progress at Argonne National Lab., October to December 1961, 16: 20296(R) (ANL-6477)
METALS
boiling 2-propanol and water on surfaces, nucleate, 16: 20618
deformation resistance of strengthened, 16: 21069
densities and heat capacities, 16: 21041(R) (TID-15663)
diamagnetic shielding of nuclei by conduction electrons, 16: 21215
electron distribution functions in anisotropic, Boltzmann equations, 16: 21211
electron enhancement around positive point charges in, 16: 21201
electron gas at high temperatures in, perturbative effects, 16: 21217
electron range in, 16: 21197
fatigue, theory of high stress level, 16: 20805 (ARL-181)
oxidation and ignition kinetics, 16: 20300(R) (ANL-6477(p.168-203))
oxidation-reduction states, determination by use of hydroquinone–krypton-85 clathrates, 16: 20324(R) (TID-15661)
preparation of alloy samples, design of arc melting furnace for, 16: 20989 (ASD-TN-61-32)
production by vacuum metallurgy, 16: 20967
purification of reactive, by electrolysis, 16: 20969(P)
radiation effects, displacement-spike formation mechanisms, 16: 21106
reactions with water, reactor safety studies, 16: 20300(R) (ANL-6477 (p.168-203))

separation of ions in fused salts by electrophoresis on glass fiber paper, 16: 20550
sputtering by bombardment with rare-gas ions, yields at low energies, 16: 21116 (AD-267458(Pt.V))
sputtering yields from rare-gas ion bombardments, 16: 21114(R) (AD-267458)
METALS (LIQUID)
electronic structure, 16: 20439
heat transfer, 16: 20042(R) (BNL-696)
lubricity, magnetohydrodynamic analysis, 16: 20570
METEORITES
carbon-14 content in iron and stone, age estimations from, 16: 20828
description and radioactivity analysis of Ehole (Angola), 16: 20842
dust production by micro-, on lunar surface, 16: 21132 (NP-11652)
frequency, mass, and impact data, 16: 20233
silver isotopic composition in iron, 16: 20829
tritium content in iron and stone, 16: 20827
METEOROLOGY
definition of extreme desert environments with microclimatological measurements, 16: 20821 (SC-4853(RR))
METHACRYLIC ACID, METHYL ESTER POLYMERS
polymerization with acrylonitrile, effects of pre-irradiation, 16: 20502
METHANE
radiolysis in presence of xenon, 16: 20524(P)
reactions with hydrogen from plasma torch, kinetics and thermodynamics, 16: 20391
METHANE (LABELED)
radiolysis by electron bombardment, identification of products from, 16: 20495
METHANESULFONIC ACID, ETHYL ESTER
mutagenic effects on plants, 16: 20208
METHANOL
radiation effects on decomposition with zinc oxide, 16: 20516
METHYL PHENYL SULFIDE
deuterium exchange, acid-catalyzed, 16: 20306
METHYLAL
spectra, effects of deuterium substitution on infrared, 16: 20447
METHYLENE BLUE
protective effects against radiation in embryo intestine and testis, 16: 20186
MICE
cataract development in, from wounds after x irradiation, 16: 20200
cataract induction in frogs and mice after x irradiation, 16: 20200
effects of lethal irradiation on adaptation of incompatible bone marrow, 16: 20282
mortality in short-duration overpressures, 16: 20864(R) (DASA-1242)
radiation effects on antibody formation by spleen cells in, 16: 20274
radiation effects on erythropoiesis in pregnant, 16: 20190
radiation effects on fertility, deformities, postnatal and infant mortality, and sex ratio, 16: 20220
radiation effects on tritium incorporation in brain and liver, 16: 20221
radiation effects, protective effects of spleen cells against, 16: 20263
radiation effects on immune responses, 16: 20267
radiation effects on tumor metastasis in, 16: 20268
radiation effects on lymphocytic choriomeningitis in, 16: 20271
radiation effects on lymphocytic choriomeningitis in, 16: 20272
radiation effects on antibody-forming cells, 16: 20273
radiation effects on cycle and oestrus, evaluation of methods for determining, 16: 20288
radiation effects on survival of albino, effects of dietary deficiencies on, 16: 20130 (NP-11741)
radioprotective effects of liver, spleen, and bone marrow cells in, 16: 20160
transmission of maternal erythrocytes across placenta, radiation effects, 16: 20066
transmission of serum albumin from mother to fetus, radiation effects, 16: 20067
MICROWAVE EQUIPMENT
development of directional coupler in oversize waveguide, 16: 20671
development of optical maser program, 16: 21129(R) (NP-11640)
MICROWAVE OSCILLATORS
power amplifier design using parallel klystrons and flywheel, 16: 20662
MILK
cesium-137 content in Argentina, 1961, 16: 20856 (A/AC.82/G/L.746)
contamination through exposed cattle or contaminated pastures, 16: 20124
iodine-131 content in Egypt, 1956 to 1957, 16: 20125
iodine-131 content in Italy, Oct. to Dec. 1961, 16: 20127
monitoring, 1961, 16: 20906
monitoring, 1961 and 1962, 16: 20907
radioactive, removal from surfaces, 16: 20071
radiological monitoring, 1961, 16: 20905
strontium dietary availability from, tracer study, 16: 20899
MITOSIS
inhibition by irradiated media, 16: 20204
radiation effects energy dependence, 16: 20212
MIXER-SETTLERS
design for use in removing TBP from aqueous streams, 16: 20534(R) (IDO-14574)
MOLECULAR BEAMS
electric resonance and velocity selection in, 16: 21129(R) (NP-11640)
MOLECULAR STRUCTURE
orbitals in nonsaturated compounds, computer program for calculations, 16: 20359 (NP-11530)
MOLECULES
chemical bonds, analysis by absorption spectra, 16: 21221
heavy-particle scattering by diatomic, 16: 21122 (AFCRL-1062-II)
MOLYBDENUM
content in standard rocks G-1 and W-1, 16: 20830
determination as trace in standard rocks G-1 and W-1, spectrographic, 16: 20831
fabrication by explosive forming, effects of 0.5% titanium, 16: 20994(R) (NP-11621)
hardness, 16: 21080
hardness and tensile properties, 16: 20955(R) (NMI-2105)
radiation effects on brittle-ductile transition, neutron, 16: 21068
secondary emission from bombardment with neutral argon atoms and argon ions, 16: 21156
separation from aqueous solutions by cellulose, lignin, oxycellulose, and wood, 16: 20090
MOLYBDENUM ALLOYS
machining studies, 16: 20990(R) (ASD-TR-7-532e(VI))
MOLYBDENUM ISOTOPES Mo-98
neutron capture cross sections, 16: 20302(R) (ANL-6477(p.217-23))
MOLYBDENUM ISOTOPES Mo-99
separation from neutron-irradiated uranium by fractionated sorption on aluminum oxide, 16: 20544
yield from neutron fission of uranium-235, 16: 21347 (AWRE-0-58/61)
MOLYBDENUM–OSMIUM ALLOYS
phase studies, 16: 21036(R) (NMI-9235)
MOLYBDENUM–RHENIUM ALLOYS
hardness and tensile properties, 16: 20955(R) (NMI-2105)
MOLYBDENUM SILICIDES
heats of formation, 16: 20394
MOLYBDENUM–TITANIUM ALLOYS
welding, effects of various parameters for ultrasonic, 16: 20987(R) (AD-266249)
MOLYBDENUM–TITANIUM–ZIRCONIUM ALLOYS
joining by fiber metal resistance brazing, 16: 20988 (ARF-2232-2)
MONAZITES
analysis for lead, radium, and thorium, 16: 20325(T) (NP-tr-895)
analysis for rare earths, thorium, and uranium, 16: 20343
MONKEYS
immunization by irradiated *Schistosoma mansoni* cercariae, 16: 20202
radiation effects on poliovirus yield in cultured kidney cells from rhesus, 16: 20201
MONTE CARLO METHOD
calculation of reflection and transmission of scattered gamma radiations from concrete, 16: 21693 (NP-11819)
use for calculating neutron absorption in square lattices, 16: 21715 (BAW-154)
MOON
probe design for, subsurface geophysical, 16: 20659
surface damage from cosmic radiation and micrometeorites, 16: 21132

(NP-11652)
MORPHOLOGY
surgical treatment of radiation ulcerations on skin, 16: 20278
MOTORS
drive transmission for rotary members, 16: 21751(P)
MULTIPLICATION FACTOR
fission products effects, uncertainties in predicted, 16: 21814 (KAPL-M-ECH-8)
MUSCLES
contents of bromine, iron, and zinc in human, 16: 20098
radiation damage reaction with mechanical trauma biochemical analysis, 16: 20166
MUTATIONS
radioinduced in *Chlamydomonas reinhardi* by ultraviolet light, 16: 20203
radioinduced in Drosophila, 16: 20175
radioinduced in Drosophila, 16: 20176
radioinduced in meal moth at low doses, somatic, 16: 20281
radioinduced in potatoes, 16: 20177
radioinduced in spermatogonia and spermatozoa of *Drosophila melanogaster*, 16: 20197
radioinduced in sweet potatoes, 16: 20178
radioinduced sex-linked recessive lethal, in *Sciara coprophilia*, 16: 20138
MYRISTIC ACID
etching effects on lithium fluoride crystals, adsorption-locking and Rehinder effect in, 16: 20437

N

NAGASAKI
blood picture in bomb survivors, 16: 20248
eye cataracts in bomb survivors, 16: 20133
hematology of bomb survivors, 16: 20249
leukemia cases in bomb survivors, 16: 20251
tumor mortality in bomb survivors, 16: 20250
NATURAL WATERS
radioactivity effects in humans, 16: 20229
NAVAL VESSELS
nuclear-powered, evaluation of collision-resisting sides, 16: 20573
NEMATODES
radiation effects on immunogenicity of *Trichinella spiralis*, 16: 20137
radiation effects on infectivity and reproductive capacity of *Trichinella spiralis*, 16: 20135
NEODYMIUM CHLORIDES
spectra of neodymium ions in, line widths of emission, 16: 21205
NEODYMIUM IONS
spectra in crystalline salts, line widths of emission, 16: 21205
spectra, time-resolved, 16: 20430
NEODYMIUM ISOTOPES
nuclear gyromagnetic ratios and quadrupole moments, 16: 21446
NEODYMIUM ISOTOPES Nd-141
nuclear spin, 16: 20305(R) (UCRL-10023)
NEODYMIUM OXIDES
analysis for impurities, spectrographic method for, 16: 20327
NEON
proton scattering near 100 kev, ionization cross sections, 16: 21218
spectra, excited by alpha and electron impacts in pure, 16: 21147
stopping in hydrogen, 16: 21628
NEON ISOTOPES Ne-20
energy-level lifetimes, 16: 21441
energy levels and dipole gamma spectra, 16: 21452
energy levels and wave functions, 16: 21501
energy levels, de-excitation branching and radiative widths of 5.63 and 5.80 Mev states, 16: 21633
proton reactions (p,p′γ), assignment of 4.97 Mev level from, 16: 21632
NEON ISOTOPES Ne-22
proton reactions (p,γ), resonances in, 16: 21498
NEPTUNIUM
separation from elements with atomic numbers 89 to 95 by paper chromatography, 16: 20340
NEPTUNIUM ISOTOPES Np-237
neutron capture cross sections, 16: 20302(R) (ANL-6477(p.217-23))
NERVES
radiation effects of alpha particles on fibers from frog skin, 16: 20134
NERVOUS SYSTEM
metabolic influence during radiation sickness, 16: 20192
radiation effects on adrenergic transmission in cats, 16: 20143
NEUTRINOS
reactions with nuclei at intermediate energy, 16: 21425
NEUTRON CAPTURE CROSS SECTIONS
Monte Carlo program for, 16: 20933 (WAPD-TM-273)
NEUTRON CROSS SECTIONS
calculations for shielding data, computer programs for, 16: 21691 (DC-60-7-9)
tabulation for beryllium, 16: 21334 (DC-60-12-98)
NEUTRON DIFFRACTOMETERS
design of crystal, 16: 20678
NEUTRON PHOTOGRAPHY
backing materials evaluation, 16: 20665
methods and uses, evaluation, 16: 20810
NEUTRON SHIELDING
development of light-weight boron materials for, 16: 21690(R) (AD-267561L)
NEUTRON SOURCES
calibration of NBS standard thermal, 16: 21339
design and performance of 300-kev electrostatic, 16: 21657
design of Argonne Thermal Source Reactor, 16: 21714 (ANL-6440)
flux angular distribution of T(d,n), 16: 21370
use of 250-kv Cockcroft-Walton accelerator with frozen water-d, target, 16: 21654
yield and angular distribution from Zr–tritium target, 16: 21371
NEUTRON SPECTRA
analysis of thermal-neutron-induced fast, in natural uranium, 16: 21338
measurements using bubble chambers, 16: 20683
NEUTRON SPECTROMETERS
design and performance of silicon surface-barrier-type, for fast neutrons, 16: 20745
design and performance of gaseous scintillations, using helium-3, 16: 20710
design of address scaler and temporary memory for a transistorized time-of-flight analyzer, 16: 20763
design of devices for processing data from, 16: 20771
design of transistorized 1024-channel time-of-flight analyzer, 16: 20762
design of two-dimensional selector, 16: 20765
design of 1024-channel magnetic drum time analyzer for, 16: 20779
design of 20-MHz transistorized timer for, 16: 20766
performance of bubble chambers as, 16: 20683
performance using semiconductor detectors, 16: 20752
NEUTRON TOTAL CROSS SECTIONS
tabulation for protactinium-231 at 0.01 ev to 2 kev, 16: 21349 (IDO-16698)
NEUTRONS
absorption in square lattices, Monte Carlo code for, 16: 21715 (BAW-154)
age to thermal in heterogeneous lattices, 16: 21710 (AEET/RE/1)
angular distributions and energy spectra from deuteron-proton interactions, 16: 21475
angular distributions from alpha reactions with lithium-7 at 13.5 to 13.9 Mev, 16: 21602
detection and measurement using semiconductor detectors, 16: 20754
detection and measurement, semiconductor counter for, 16: 20755
detection and measurement, gamma-insensitive scintillation counter for, 16: 20787
detection and measurement, liquid scintillation counters for, 16: 20709
detection and measurement using cerium-activated vitreous scintillators, 16: 20716
diffraction patterns from crystal spectrometers, 16: 20678
diffusion and transport in cylinders, effects of voids, 16: 21330 (AD-267646)
diffusion calculations, EQUIPOISE 3A two-group code, 16: 20930 (ORNL-3199(Add.))
diffusion, numerical solution by digital computers, 16: 21341
dosage determinations for personnel exposed to nuclear excursion, computer program for, 16: 20877 (Y-1386)

flux measurement techniques in space, 16: 21228
interactions with deuterons at 14.4 Mev, determination of neutron-neutron scattering length from, 16: 21472
interactions with neutrons, scattering length for, 16: 21472
interactions with mesons (K^-), Λ-π resonance in, 16: 21482
interactions with protons at 27 Bev, cross sections for inelastic, 16: 21286
lifetimes in glass scintillation detectors, Monte Carlo calculations, 16: 21125(R) (ANL-6517)
mass difference with protons, meson (π) cloud effects on, 16: 21285
polarization by scattering on nuclei at 2.09 Mev, optical model analysis, 16: 21539
production by tritium–deuteron reactions at 8 to 200 kev, yield, 16: 21358 (SERL-TR-M-61)
production in Brookhaven Alternating Gradient Synchrotron proton beam at 30° and 30 Bev, 16: 21650 (NP-11624)
production in helium-3 reactions with tritium at 3.23 Mev, 16: 21573
production in proton reactions with nuclei (Z = 4 to 50) at 32 Mev, 16: 21479
production in reactions (μ^-, $n\nu$) on sulfur nuclei with polarized muons, angular asymmetries, 16: 21426
reactions (n,α) and (n,p) in cesium iodide at 12.1 to 21.5 Mev, energy spectra and cross sections from, 16: 21552
reactions (n,α), (n,2n), and (n,p) with nuclei around Z = 40, cross sections, 16: 21586
reactions (n,d) with vanadium-51, angular distributions from, 16: 21554
reactions (n,γ) on nuclei, gamma resonance effects, 16: 21454
reactions (n,pn) with carbon-12 at 120 to 150 Mev, gamma spectra of residual nuclei, 16: 21466
reactions (n,2n) and (n,p) with cobalt-59 and zinc-64 at 13.8 to 14.8 Mev, 16: 21385
reactions with nuclei, cross sections and excitation function, 16: 21352 (NP-11667)
resonance absorption, effects of nonuniform temperature distributions, 16: 21340
scattering by graphite, heavy water, and water, 16: 21331 (AERE-R-4019)
scattering by lead, excitation cross sections in inelastic, 16: 21545
scattering by nitrogen –15 at 1.9 to 3.5 Mev, cross sections for elastic, 16: 21394
scattering by nuclei, wave distortion in inelastic, 16: 21591
scattering by nuclei, non-local potential model for, 16: 21390
scattering by water, constants for approximation functions, 16: 21342
scattering in thin plates, probabilities for double, single, and triple, 16: 21125(R) (ANL-6517)
transport in fuel elements, monoenergetic treatment, 16: 21344
transport theory, FORTRAN program MO150 for, 16: 20934 (WAPD-TM-315)
transport theory, Yvon approximation method, 16: 21336

NEVADA PROVING GROUNDS AREA
monitoring of environs, 1962, 16: 20907

NICKEL
alpha scattering at 43 Mev, excitation of collective levels by inelastic, 16: 21514
coating with thorium by electrolysis, 16: 20963
corrosion by acids and chloride salts in chemical plants, 16: 20983
determination as trace in standard rocks G-1 and W-1, spectrographic, 16: 20831
determination in rare earth oxides, spectrographic method for, 16: 20327
deuteron reactions (d, helium-3) at 21.6 Mev, determination of configurations of states by, 16: 21562
magnetic properties, effects of hydrogen, 16: 21010(R) (AD-264878)
plastic deformation of sintered, 16: 21081
recovery and recrystallization after cold deformation, 16: 21082
thermodynamics in lithium and potassium chloride systems (liquid), oxygen equilibrium potential diagram for, 16: 20426

NICKEL ALLOYS
dissolution of Nichrome fuel element materials in nitric acid, electrolytic, 16: 20534(R) (IDO-14574)

NICKEL IONS
paramagnetic resonance in double-nitrate crystals, 16: 20412

NICKEL ISOTOPES
nuclear potentials, evidence for distortion, 16: 21565

NICKEL ISOTOPES Ni-58
alpha elastic and inelastic scattering at 43 Mev, 16: 21421
deuteron reactions at 21.6 Mev, angular distributions and cross sections, 16: 21557
energy levels and E3 and E4 gamma spectra, 16: 21450
proton angular distributions to excited 2+ and 3– states, parity change determinations from, 16: 21556
proton inelastic scattering at low energies, reaction mechanisms for, 16: 21393
proton reactions (p,α) at 18 Mev, seniority wave function effects on angular distributions and cross sections, 16: 21578
proton scattering at 2 to 5 Mev, resonances in, 16: 21543

NICKEL ISOTOPES Ni-59
proton reactions (p,α) at 18 Mev, seniority wave function effects on angular distributions and cross sections, 16: 21578

NICKEL ISOTOPES Ni-60
alpha elastic and inelastic scattering at 43 Mev, 16: 21421
alpha scattering at 43 Mev, angular distributions to excited states, 16: 21560
deuteron reactions at 21.6 Mev, angular distributions and cross sections, 16: 21557
energy levels and E3 and E4 gamma spectra, 16: 21450
proton angular distributions to excited 2+ and 3– states, parity change determinations from, 16: 21556
proton inelastic scattering at low energies, reaction mechanisms for, 16: 21393
proton scattering at 31 Mev, cross sections for inelastic, 16: 21576

NICKEL ISOTOPES Ni-61
deuteron reactions at 21.6 Mev, angular distributions and cross sections, 16: 21557
nuclear properties, study by Mössbauer effect, 16: 21447

NICKEL ISOTOPES Ni-66
yield from neutron fission of uranium-235, 16: 21347 (AWRE-0-58/61)

NICKEL OXIDE FILMS
radiation effects on, applied to glass, 16: 21108

NICKEL SALTS
boiling of aqueous solutions, hydrodynamic model for nucleate pool, 16: 20605

NIOBIUM
brittle-ductile transition, 16: 21068
corrosion by acids and chloride salts in chemical plants, 16: 20983
emissivities with and without nitrogen at 810 to 2132°C, 16: 21077
fabrication by explosive forming, 16: 20994(R) (NP-11621)
oxidation at 1900 to 2300°F, effects of aluminum–zinc and zinc coatings, 16: 21031 (DC-60-8-25)
strain-aging, effects of titanium, vanadium, and zirconium additions, 16: 21063

NIOBIUM ALLOYS
machining studies, 16: 20990(R) (ASD-TR-7-532a(VI))
strain-aging, effects of titanium, vanadium, and zirconium additions, 16: 21063

NIOBIUM BROMIDES
heat of formation, 16: 20450

NIOBIUM ISOTOPES Nb-93
neutron reactions (n,α) at 14.7 Mev, cross sections, 16: 21352 (NP-11667)

NIOBIUM ISOTOPES Nb-94
neutron activation cross sections, thermal, 16: 21839(R) (IDO-16760)

NIOBIUM ISOTOPES Nb-95
content in drinking waters in England, 16: 20126
determination in shore sand and sea silt, gamma-spectrometric, 16: 20323 (PG-Report-312)
separation from waste solutions by flocculation, 16: 21862

NIOBIUM NITRIDES
emissivity, 16: 21077

NIOBIUM–RHENIUM ALLOYS
hardness, 16: 20955(R) (NMI-2105)

NIOBIUM SILICIDES
heats of formation, 16: 20394

NIOBIUM STEEL
corrosion by hydrofluoric acid, 16: 20535(R) (IDO-14583)

NIOBIUM–TIN–ZIRCONIUM ALLOYS
preparation, 16: 20980(T,R) (EURAEC-26)
NIOBIUM–TUNGSTEN ALLOYS
properties evaluation for alkali metal containment, 16: 21037(R) (NP-11614)
NIOBIUM–ZIRCONIUM ALLOYS
corrosion by sodium at 2200°F, 16: 20042(R) (BNL-696)
corrosion rates in steam at 400°C and 200 atm, 16: 20981(T,R) (EURAEC-27)
corrosion rates in steam or water at 360, 400, and 480°C, effects of heat treatment, 16: 20982 (T,R) (EURAEC-85)
corrosion resistance, effects of heat treatment, 16: 20980(T,R) (EURAEC-26)
metallography, 16: 20042(R) (BNL-696)
phase studies, 16: 20981(T,R) (EURAEC-27)
phase studies, 16: 20982(T,R) (EURAEC-85)
phase studies, 16: 21061
tensile properties, 16: 20981(T,R) (EURAEC-27)
welding, effects of gases, 16: 20807 (NP-11694)
NITRATES
radiation effects, measurement of amount and composition of radiation products, 16: 20466 (AERE-R-3409)
spectra, lattice frequencies and rotational barriers in infrared, 16: 20416
NITRIC ACID
corrosive effects on alloys and metals in chemical plants, 16: 20983
proton paramagnetic resonance in aqueous solutions, 16: 20464
NITRIC ACID–2-PENTANONE, 4-METHYL- SYSTEMS
electric conductivity of aqueous, 16: 20534(R) (IDO-14574)
NITRIDES
crystal structure and properties of metal, of first secondary groups of the periodic system, 16: 20379(T) (UCRL-Trans-817)
NITROGEN
abundance in Venus atmosphere, 16: 21228
determination by activation with charged particles, 16: 20321 (NP-11608)
effects on radiation effects on embryo intestine and testis, 16: 20186
electric conductivity at 2000 to 7000°K, effects of seeding with low ionizing potential substances, 16: 21663 (ARL-62-310)
polarization, theoretical basis for calculation, 16: 21121 (AFCRL-1062-I)
proton scattering near 100 kev, ionization cross sections, 16: 21218
solubility in boron–iron systems, 16: 21073
treatment for chemical combination, 16: 20580(P)
NITROGEN (LIQUID)
boiling, relation between bubble diameter and frequency in, 16: 20601
NITROGEN ISOTOPES N-13
angular distributions and ranges from magnesium-24 (N^{14},N^{13}) reaction, 16: 21416
production by photodisintegration and electrodisintegration of oxygen-15, excitation curves, 16: 21377
NITROGEN ISOTOPES N-14
deuteron reactions (d,p) at 27 Mev, angular distribution of protons and elastically scattered deuterons, 16: 21355 (NP-11697)
energy levels and dipole gamma spectra, 16: 21452
fluorine isotope reactions (F^{19},F^{18}) up to 43 Mev, 16: 21428
nucleon pairing forces in, non-canonical transformation for calculation, 16: 21509
reactions with boron-10, boron-11, magnesium-24, and nitrogen-14 at 28 Mev, nucleon transfer in, 16: 21575
reactions with fluorine-19 and oxygen-16 at 21.4 to 27.4, angular distributions from, 16: 21625
reactions with lead-207 and lead-208, energy level selection in neutron transfer in, 16: 21536
reactions with magnesium-24, angular distribution and ranges of nitrogen-13 from, 16: 21416
NITROGEN ISOTOPES N-15
alpha reactions (α,d), 16: 20305(R) (UCRL-10023)
energy levels excited by (α,p) reactions on carbon-12, 16: 21417
neutron elastic scattering at 1.9 to 3.5 Mev, cross sections for, 16: 21394
proton reactions (p,γ), excitation and giant dipole resonance in, 16: 21510
NITROGEN ISOTOPES N-16
energy levels, 16: 21394
NITROGEN MUSTARDS
effects on leukocyte metabolism, 16: 20062
NITROGEN OXIDES (LIQUID)
radiolysis of nitrous, G values for, 16: 20514
NITROGEN–XENON SYSTEMS
electric discharge, constriction, volt-ampere characteristics, and volume recombination of the positive column, 16: 21179
NOISE
generation at 1 to 10 kc of white, in exosphere, 16: 21231
NPD REACTOR
design and characteristics, 16: 21832
design, public relations release, 16: 21792 (AECL-1458)
NRU REACTOR
design and safety analysis, 16: 21793 (AECL-1495)
NRX REACTOR
design and safety analysis, 16: 21793 (AECL-1495)
stack dilution tests, 16: 20858 (AECL-1518)
NUCLEAR BATTERIES
design of casing for, 16: 20583(P)
NUCLEAR CHEMISTRY
development trends, 16: 20484
NUCLEAR EMULSIONS
development of Ilford C2 and K2, 16: 21145
hyperon (Σ) interactions in, sign of nuclear potential, 16: 21483
mesic atoms decay modes in, relative probabilities, 16: 21534
meson (π^-) interaction lengths and elastic scattering at 309 Mev, 16: 21406
particle track grain densities, 16: 20677
sensitivities in, heating effects on, 16: 20685
NUCLEAR ENGINEERING
design techniques utilizing computers, 16: 21833
NUCLEAR MAGNETIC MOMENTS
measurement in excited states by resonance fluorescence methods, 16: 21448
pair-interaction effects, 16: 21433
NUCLEAR MAGNETIC RESONANCE
equipment design with resonance control, 16: 20705(P)
measurement, sample holder for, 16: 20703(P)
sample orientation for spectrum measurements, 16: 20701(P)
spectrometer design for comparing two samples, 16: 20704(P)
NUCLEAR MODELS
cluster and shell, comparison for lithium-6, 16: 21429
development and results of asymmetric-rotor, 16: 21460
energy width variations near threshold interpretation by, 16: 21543
many-body perturbation methods and summation of bubble graphs for, 16: 21512
NUCLEAR MODELS (COLLECTIVE)
characteristics of asymmetric-core, for odd-A nuclei, 16: 21459
NUCLEAR MODELS (OPTICAL)
cross sections for compound-nucleus formation, resonance contributions to calculations, 16: 21624
potential, shape of imaginary part, 16: 21540
NUCLEAR MODELS (SHELL)
gamma transition probabilities in, effects of residual interactions, 16: 21432
rotation and vibration effects in calculations by, 16: 21622
solutions for pairing plus quadrupole-quadrupole interactions, 16: 21507
NUCLEAR PARTICLES
detection and measurement, design of particle identification system, 16: 20799
production of many, theory, 16: 21270(T) (UCRL-Trans-825)
NUCLEAR PHYSICS
conference, Rutherford Jubilee, Manchester, 1961, 16: 21462
development trends, 16: 20484
research programs at NRL, 16: 21130(R) (NP-11643)
NUCLEAR POWER
economic aspects, effects of nuclear insurance rates, 16: 21733
research progress in Australia, 1960 and 1961, 16: 20044 (NP-11606)
NUCLEAR POWER PLANTS
boiler design and operation in, 16: 20622(P)
book: *Dosimetric and Special Technological Rules for Nuclear Power,*

16: 20903
cost calculation methodology, 16: 21828
design, 16: 21834(P)
design for superheated steam, 16: 21835(P)
design techniques utilizing computers, 16: 21833
development and shielding for space vehicles, 16: 20236
NUCLEAR QUADRUPOLE RESONANCE
theory and experimental observation, review, 16: 21169
NUCLEAR REACTIONS
advantages of polarized nuclei in direct, 16: 21574
amplitudes, kinematic branch points of n-line scattering graphs, 16: 21208
calculations of direct, finite-range distorted-wave Born-approximations for, 16: 21579
cluster effects in, 16: 21572
cross-section calculations, relation of optical model and resonance theory, 16: 21624
cross sections, contribution of multiquantium exchange terms to ratio of total (α,x) to total (γ,x), 16: 21469
direct, by single particle modes, 16: 21266 (NP-11680)
direct, calculations and experimental evidence for, 16: 21547
direct process, review, 16: 21546
distortion of incident and emergent waves in direct, 16: 21550
gamma resonance effects in (p,γ), 16: 21452
gamma resonance effects in (n,γ), 16: 21454
gamma spectra from high-energy, 16: 21389
gamma transitions involving continuum states, 16: 21451
heavy-ion, models for gamma distributions and yields, 16: 21457
magnitude of two-nucleon stripping, calculation by pairing interaction model, 16: 21604
nucleon indistinguishability in, 16: 21623
nucleon transfer probability in, theory, 16: 21555
of alpha particles at ~10^{13} ev/nucleon, 16: 21404
of neutrinos at intermediate energies, 16: 21425
polarization effects in, 16: 21548
polarization in direct, correlations between incoming and outgoing, 16: 21590
research programs on meson-induced, 16: 20305(R) (UCRL-10023)
research programs at Orsay linear accelerator, 16: 21646(R) (LAL-1010)
research programs at Orsay linear accelerator, 16: 21647(R) (LAL-1021)
transition matrix for scattering of free particles by systems of identical bound particles, 16: 21312
use of recoil methods for short lifetime measurements, 16: 21441
NUCLEAR SPECTRA
research progress, review, 16: 21621
NUCLEAR STRUCTURE
analysis by optical model studies of elastic scattering, 16: 21529
determination by electron scattering on nuclear protons, 16: 21471
determination from interactions of fast nucleons with nuclei, 16: 21464
deuteron properties in nuclear matter, 16: 21403
many-body problem in, 16: 21530
many-body problem, boundary condition model for, 16: 21541
measurements, interpretation of gross, 16: 21583
properties, limitations and needs in instrumentation and techniques for studying, 16: 21605
NUCLEAR THEORY
angular momenta coupling in two-particle states in deformed even-even nuclei, 16: 21423
boundary condition model of nuclear forces, 16: 21478
classes of quadrupole magnetic gamma transitions, 16: 21376
electromagnetic lifetimes and properties of nuclear states, 16: 21431 (NAS-NRC-Pub-974)
energy levels of oxygen-18, calculation from free-nucleon potentials, 16: 21365
forces in nuclear reaction, velocity-dependent, 16: 21619
forces in nucleus, review of model development for, 16: 21463
magnetic moments of nuclei, effects of pair interactions, 16: 21433
mass constancy for low momenta, 16: 21700
nuclear molecule consisting of two C^{12} nuclei, 16: 21220
nuclear reactions of intermediate-energy neutrinos, 16: 21425
nucleon–nucleon triplet–even potentials and scalar form factor, 16: 20305(R) (UCRL-10023)
of (α,t) reactions, 16: 20305(R) (UCRL-10023)
tables of Clebsch-Gordan coefficients, 16: 21348 (IFA/FT/40)
velocity-dependent nuclear forces and their effects in nuclear matter, 16: 21535
NUCLEI
abundances in cosmic radiation above atmosphere, 16: 21250
alpha decay rates of spheroidal, calculation of hindrance factors, 16: 21533
alpha reactions (α,t), forward-peaking transitions in, 16: 21558
alpha reactions at 10^{13} ev/nucleon, angular distributions, 16: 21404
angular momenta coupling in two-particle states in deformed even-even, 16: 21423
cluster wave functions for, interpretation of generalized, 16: 21398
collective motion and neutron resonance spacing in highly excited, 16: 21513
data summary, chart of nuclides, second edition, 1961, 16: 21430
deformation at high angular momentum of compound, calculation by liquid drop model, 16: 21508
deuteron reactions (d,p) proton spin-orbit distortion effects in, 16: 21600
deuteron reactions (d,n) and (d,p), structure effects in, 16: 21584
deuteron reactions (d,p), graphs for determining reduced widths in, 16: 21356 (NYO-2666)
deuteron widths in 1p-shell, estimates by harmonic oscillator wave functions, 16: 21354 (NP-11682)
diamagnetic shielding by conduction electrons in metals, 16: 21215
electric and magnetic properties of excited states, 16: 21446
electron scattering, momentum transfer and Pauli correlations in, 16: 21474
energy level and lifetime measurements by pulsed-beam methods, 16: 21435
energy level and lifetime measurements using r-f deflection methods, 16: 21438
energy-level lifetime measurements using gamma resonance fluorescence, 16: 21442
energy-level lifetimes, from Coulomb-excitation analysis, 16: 21444
energy levels and vibrations in even-even, 16: 21494
energy levels in light, calculation by cluster model, 16: 21496
energy levels, measurement of lifetimes of 10^{-10} to 10^{-13} sec, 16: 21441
energy width variations near threshold, cluster model interpretation, 16: 21543
forces in, velocity dependent, 16: 21703
gamma emission, magnitude of dipolar and quadrupolar, 16: 21363(T) (UCRL-Trans-822(L))
gamma E1 spectra of odd-A, in rare earth region, 16: 21458
gamma transitions in deformed even, coupling of K = 2 band to ground state rotational band, 16: 21521
giant resonance behavior in gamma elastic scattering and (p, γ) reactions, 16: 21455
heavy ion reactions, fragmentation in, 16: 21634
helium-3 scattering at 29 Mev, optical model analysis, 16: 21538
magnetic moments, effects of pair interactions, 16: 21433
meson (μ) capture by nuclei, 16: 21609
mesons (μ) reactions, spin-dependence of capture, 16: 21610
model for odd-A, asymmetric-core collective, 16: 21459
models for even-even, development of asymmetric-rotor, 16: 21460
moments of inertia, calculation by approximate second quantization, 16: 21387
momentum distribution in, relation to correlation structure, 16: 21531
neutron reactions (n,γ), gamma resonance effects, 16: 21454
neutron reactions (n,α), (n,2n), and (n,p) around Z = 40, cross sections, 16: 21586
neutron scattering at 2.09 Mev, optical model analysis of polarization by, 16: 21539
neutron scattering, wave distortion in inelastic, 16: 21591
neutron scattering, non-local potential model for, 16: 21390
nucleon reactions at high energy, determination of nuclear structure from, 16: 21464
nucleon scattering, radial dependence of optical potential for, 16: 21477
nucleon scattering, optical potential radial dependence in, 16: 21364
nucleon scattering at 3 to 25 Bev, model for, 16: 21391
octupole states in even-even, dependence of excitation energy on atomic

number for, 16: 21523
oscillations in, review of experimental evidence for collective, 16: 21492
oscillations, theory of collective, 16: 21493
pairing correlations in, 16: 21491
properties, determination using Monte Carlo method, 16: 21382
properties, study by Mössbauer effect, 16: 21447
proton scattering at 50 Mev, theoretical studies of slit, 16: 21639
proton reactions at 9 Bev, lithium-8 double emission in, 16: 21415
proton reactions in thin targets (Z = 4 to 50) at 32 Mev, neutron yields from, 16: 21479
proton reactions (p,γ), gamma resonance effects, 16: 21452
proton reactions (p,2p) at 150 Mev, binding energy and shell structure determinations from, 16: 21487
proton reactions (p,n) with mirror, angular distributions and excitation curves from, 16: 21582
reactions at high energies, gamma spectra from, 16: 21389
rotational spectra, non-adiabatic parameter, 16: 21386
rotational states and tensor of inertia of heavy, nuclear-model determination, 16: 21503
spectra of two-particle excitations in, 16: 21522
structure, effects of deuteron-type, 16: 21403
structure of mass 18, shell model calculations, 16: 21631
surface structure, methods for determining, 16: 21528
use of aligned, as gyroscopes, 16: 20654

NUCLEI (CELLS)
radiation dose received from incorporation of tritium-labeled thymidine, 16: 20222
radiation effects, 16: 20142

NUCLEIC ACIDS
radiolysis, 16: 20515

NUCLEONS
interactions at 10^{13} ev, angular distributions, 16: 21404
interactions in nuclei, effects on gamma transition probabilities, 16: 21432
interactions, potential composed of direct and exchange Yukawa potentials, 16: 21402
interactions to 100 Bev, effective target masses in, 16: 21271
interactions, velocity-dependent forces in, 16: 21703
interactions with hyperons (Λ), 16: 21465
interactions with hyperons (Λ), forces in, 16: 21470
interactions with nucleons, charge independence of nuclear forces and pseudoscalar coupling in, 16: 21473
interactions with nucleons below inelastic threshold, 16: 21480
interactions with mesons and nucleons, three-meson (π) resonance in, 16: 21620
interactions with mesons (π) to 100 Bev, effective target masses in, 16: 21271
interactions with mesons (K^+) at 50 to 210 Mev, amplitudes for, 16: 21296
interactions with mesons (K^-), partial-wave dispersion relations in, 16: 21299
interactions with mesons at 10^{10} to 10^{13} ev, angular distributions, 16: 21308
pairing and quadrupole-quadrupole interactions in nuclei, shell model for, 16: 21507
pairing forces near closed shells, non-canonical transformation for calculation, 16: 21509
reactions with nuclei, determination of nuclear structure from, 16: 21464
reactions with nuclei, distinguishability in, 16: 21623
scattering by nucleons at high energies and small angles, theory, 16: 21125(R) (ANL-6517)
scattering by nuclei, radial dependence of optical potential for, 16: 21477
scattering by nuclei, optical potential radial dependence in, 16: 21364
scattering by nuclei at 3 to 25 Bev, model for, 16: 21391

NUCLEOTIDES
labeling phosphorus in, by neutron activation, 16: 20494
pool size in experiments with tritiated thymidine, problem on, 16: 20104

O

OILS
shear transmission of 2190 TPE, 16: 20557 (AD-269396)

OLEIC ACID
toxic effects of intermediate oxidation products on yeast cells, similarity to gamma ray effects, 16: 20063

OLEIC ACID, METHYL ESTER
protective effects against radiation sickness in gonads of male mice, 16: 20285

ORES
analysis for fissionable nuclides, development of rapid method for, 16: 20328

ORGANIC COMPOUNDS
energy transfer in systems, quenching studies, 16: 20470(R) (NP-11604)
production in irradiation of carbon dioxide aqueous solutions, 16: 20492
radiation chemistry, phase effects from long-range energy transfer in, 16: 20511
radiation effects, measurement of amount and composition of radiation products, 16: 20466 (AERE-R-3409)
radioinduced polymerization of monomers with two terminal double bonds, 16: 20523
reactions, rearrangement of ion pair intermediates in, 16: 20399
reactivities and spectra of complexes with alkali metals, 16: 20453
synthesis of carbon-14 and tritium labeled, hot, 16: 20473(T) (AEC-tr-5082)

ORGANIC COMPOUNDS, METALLO-
preparation of complex germanium and silicon containing, 16: 21010(R) (AD-264878)

ORGANIC MODERATED REACTOR EXPERIMENT
fuel element design, 16: 21770(P)
fuel elements, cleaning and dissolution, 16: 20534(R) (IDO-14574)

ORGANIC MODERATED REACTORS
coolant and fuel element development, 16: 21818 (TID-14978)
fuel element design, 16: 21770(P)

OSCILLATORS
development of Pound stabilized for electron density measurement, 16: 21113 (AD-266197)

OSMIUM ISOTOPES
nuclear gyromagnetic ratios and quadrupole moments, 16: 21446

OSMIUM ISOTOPES Os-186
energy levels and gamma spectra, 16: 21461
gamma spectra, angular correlations, 16: 21446

OSMIUM ISOTOPES Os-187
half life, 16: 21405

OSMIUM ISOTOPES Os-188
gamma spectra, EO transition probabilities, 16: 21445
nuclear parameters in asymmetric-rotor model, 16: 21461

OSMIUM ISOTOPES Os-190
gamma spectra, EO transition probabilities, 16: 21445
nuclear parameters in asymmetric-rotor model, 16: 21461

OSMIUM SILICIDES
heats of formation, 16: 20394

OXETANES
radioinduced polymerization in solid state, 16: 20503

OXIDE COMPACTS
sintering of dense, continuous, 16: 21002(P)

OXIDES
radiation effects, measurement of amount and composition of radiation products, 16: 20466 (AERE-R-3409)

OXYGEN
determination by activation with charged particles, 16: 20321 (NP-11608)
effects on radiation effects on embryo intestine and testis, 16: 20186
electric conductivity at 2000 to 7000°K, effects of seeding with low ionizing potential substances, 16: 21663 (ARL-62-310)
electron attachment in, mechanism of low-energy, 16: 20407
electron elastic scattering cross sections at 0 to 15 ev, 16: 21202
equilibrium potential diagram in metal-fused chloride systems, 16: 20426
metabolism during radiation sickness, 16: 20192
polarization, theoretical basis for calculation, 16: 21121 (AFCRL-1062-I)
radiolysis of aqueous solutions, kinetics and mechanism, 16: 20520
recombination with deuterium and hydrogen in thorium oxide slurries, catalyst, 16: 20310(P)

OXYGEN IONS

electron photodetachment cross sections, 16: 21202
reactions with cadmium, palladium, and ruthenium, Coulomb excitation by, 16: 21517
reactions with palladium-108 and -110, Coulomb excitation by, 16: 21516
OXYGEN ISOTOPES O-15
production by photodisintegration and electrodisintegration of oxygen-15, excitation curves, 16: 21377
OXYGEN ISOTOPES O-16
deuteron reactions (d,α), isobaric spin conservation, 16: 20305(R) (UCRL-10023)
dipole resonance in, 16: 21510
electrodisintegration and photodisintegration at 16 to 150 Mev, 16: 21377
electron scattering, exchange correlations and momentum transfer in, 16: 21474
energy levels at 6.92 and 7.12 Mev, decay branching ratios for, 16: 21411
excited states in, computation by Green's function formalism, 16: 21520
fluorine isotope reactions (F^{19},F^{18}) up to 43 Mev, 16: 21428
gamma reactions (γ,n) at 16 to 35 Mev, integrated cross section, 16: 21377
nitrogen nucleus reactions (nitrogen-14,α) at 27.2 Mev, angular distributions from, 16: 21625
nuclear many-body problem, reaction matrix theory, 16: 21542
proton reactions (p,γ) at 15 to 2400 kev, 16: 21453
OXYGEN ISOTOPES O-17
energy levels, 16: 21365
energy levels and wave functions, 16: 21501
energy levels, asymmetric-core collective model for, 16: 21459
OXYGEN ISOTOPES O-18
energy-level lifetimes, 16: 21441
energy levels, 16: 21627
energy levels, calculation from free-nucleon potentials, 16: 21365
OXYGEN ISOTOPES O-20
energy levels, 16: 21627
OZONE
electrosynthesis, isotope effects in, 16: 20463

P

PACKAGE POWER REACTORS
power density, 16: 21827
PAKISTAN
radioactivity of glauconite from Kalabagh, 16: 20849
PALLADIUM
reactions with bismuth–uranium alloys, effects on liquid phase in, 16: 21071
PALLADIUM CATALYSTS
preparation for gas recombination in thorium oxide slurries, 16: 20310(P)
PALLADIUM ISOTOPES Pd-106
oxygen ion reactions, Coulomb excitation by, 16: 21517
PALLADIUM ISOTOPES Pd-108
oxygen ion reactions, Coulomb excitation by, 16: 21516
PALLADIUM ISOTOPES Pd-110
oxygen ion reactions, Coulomb excitation by, 16: 21516
PALLADIUM–SILICON SYSTEMS
heats of formation, 16: 20394
PALMITIC ACID
ethyl ester, protective effects against radiation damage in mammals, 16: 20284
PALMITIC ACID, METHYL ESTER
effects on radiation sickness in gonads of male mice, 16: 20285
PANCREAS
radio scanning after uptake of Se^{75}-selenomethionine, 16: 20114
PARAMAGNETIC MATERIALS
paramagnetic resonance of S-state ions in metals, 16: 21192
PARTICLE STATISTICS
use in biological studies of space environment, 16: 20246
PARTICLE TRACKS
analysis for secondary rays, 16: 20240
grain densities in emulsions, 16: 20677
location in triggered spark detectors, accuracy of, 16: 20684
scanning in film, equipment for, 16: 20630 (CERN-62-1)
PARTICLES
acceleration and preparation of charged, effects of source operating conditions, 16: 23567 (NP-11533)
conference on aerodynamic capture, 16: 21224
in space, erosive action on metals in region of terrestrial planets, 16: 20233
pure states of n-identical, superselection principles, 16: 21280
transport by water film on ideal surface at 0.08 slope, 16: 20594 (USNRDL-TR-436)
PATHOLOGY
book: *Atlas of Pathological Anatomy of Acute Radiation Sickness in Experiment*, 16: 20295
2,4-PENTANEDIONE, 3-CYANO-
preparation and stretching frequency of cyano group in metal complexes with, 16: 20421
2-PENTANOL, 2-METHYL-
solvent properties for protactinium, 16: 20451
PERCHLORIC ACID
proton paramagnetic resonance in aqueous solutions, 16: 20464
solvent extraction with TBP in carbon tetrachloride, 16: 20305(R) (UCRL-10023)
PEROXIDES
determination, identification, and production for free radical, mass spectrometric studies, 16: 20339
PERSONNEL
radiation protection, development of 200-mr dosimeter for, 16: 20625(R) (AD-265927)
PERTURBATION THEORY
electron-gas perturbations at high temperatures in solids, 16: 21217
for accelerators with a general magnetic field, 16: 21648 (MURA-634)
momentum-space vertex function analyticity properties, 16: 20937
vacuum expectation expansion in field theory, 16: 20938
PERU
uranium prospecting, 16: 20818 (RME-4517)
uranium prospecting, 16: 20819 (RME-4521)
PHANTOMS
design of human, 16: 20884
PHENANTHRENE
electron spectra at low temperatures, comparison of normal and deuterated, 16: 20308
PHOSPHATE COMPLEXES
with amminerstheniun(III) compounds, preparation and composition, 16: 20422
PHOSPHATE GLASS
radioinduced coloration in silver, gamma, 16: 21099
PHOSPHATES
preparation of labeled, 16: 20475(T) (CEA-tr-X-434)
radiation effects, measurement of amount and composition of radiation products, 16: 20466 (AERE-R-3409)
PHOSPHORIC ACID, ALKYL ESTERS
solvent properties of di(2-ethylhexyl) ortho-, for rare earths, 16: 20546
PHOSPHORS
efficiency of plastic, compared with anthracene for compensation of Compton effect, 16: 20673
electric and conductivity, phonon bombardment effects, 16: 21010(R) (AD-264878)
preparation and scintillation efficiency of plastic, for thermal neutrons, 16: 20717
pulse-form discrimination in organic crystals, 16: 20788
scintillation efficiency of organic, 16: 20708
scintillation efficiency of cerium-activated vitreous, for neutron detection, 16: 20716
PHOSPHORS (LIQUID)
quenching kinetics in, 16: 21158
PHOSPHORUS
determination in chicken by neutron activation, 16: 20337
determination in rare earth oxides, spectrographic method for, 16: 20337
metabolism by leukocytes, effects of nitrogen mustard, 16: 20062
metabolism in heart, effects of exercise and age, tracer study, 16: 20091
metallurgical effects on corrosion of rare earths, 16: 20971(R) (AD-266150)
PHOSPHORUS ISOTOPES P-31
alpha reactions (α,p), proton angular distributions, 16: 21417

energy level schemes, intrinsic states in, 16: 21407
gamma scattering, properties of giant resonance, 16: 21456
proton reactions (p,γ), resonances in, 16: 21497
PHOSPHORUS ISOTOPES P-32
diagnostic use in pigmentary neoplasms in eye, 16: 20073
distribution in embryo and fetus following injection in pregnant female, 16: 20110
preparation in nucleotides by neutron activation, 16: 20494
recovery from irradiated materials, survey of development of separation methods, 16: 20500
separation from waste solutions by flocculation, 16: 21862
use in treatment of polycythemia vera, 16: 20117
PHOTOCONDUCTIVITY
radioinduced in Mylar, 16: 21088 (DOFL-TR-1037)
PHOTOELECTRIC CELLS
performance of phototubes under pulse conditions, 16: 21437
PHOTOELECTRIC EFFECT
dependence on material and temperature, 16: 21142(T) (CEA-tr-A-1087)
PHOTOGRAPHIC EMULSIONS
cosmic-shower measurement using, microphotographic methods in, 16: 20681
PHOTOGRAPHIC FILM
density graduations of developed negatives, measuring using bremsstrahlung scattering, 16: 21170
envelope for daylight development of x-rays, 16: 20584(P)
PHOTOGRAPHIC FILM DETECTORS
design and fabrication, 16: 20879(T) (NP-tr-904)
gamma field control with, 16: 20088
gamma field positioning with, 16: 20087
particle track analysis, equipment for, 16: 20630 (CERN-62-1)
performance for measurement of tritium dose, 16: 20687
PHOTOMETERS
control for evaluation of particle tracks in photographs, 16: 20630 (CERN-62-1)
PHOTOMULTIPLIER TUBES
design and performance of windowless, 16: 20724
development of fast multi-dynode, 16: 21436
development of type FM 50, for standard scintillation counters, 16: 20727
performance in time region less than one nanosecond, 16: 20725
performance, methods for study of, 16: 20728
PHOTONEUTRONS
emission from beryllium-9, polarization in, 16: 21410
PHOTONS
electric dipole moment, upper limits for longitudinal, 16: 21314
energy distribution in equilibrium emission spectra, tables for, 16: 21225
quantum-electrodynamical integrals of motion, 16: 21310
scattering by nuclei at 4 to 24 Mev, cross sections for inelastic, 16: 21641
PHYSICS
book: *Solid State Physics. XIII.*, 16: 21221
book: *Solid State Physics. XI.*, 16: 21222
hydrodynamic and hydromagnetic stability, variational principles for problems in, 16: 20945
research progress under U. S. Army auspices, 1961, 16: 20043(R) (NP-11537)
scattering of acoustic and elastic waves by surfaces of arbitrary shape, 16: 21137 (UCRL-6779)
solutions of modified Dirac equation, 16: 21261 (AFOSR-TR-60-172)
spin matrix exponentials and transmission matrices, 16: 21707
theory of magnetic rotation spectra, 16: 21159
transfer functions, properties of certain classes, 16: 21219
PIEZOELECTRIC CRYSTALS
stress analysis with, 16: 20808 (PNE-105P)
PINCH DEVICES
design and performance of theta-type, 16: 21669
design for plasma compression in 10000-gauss magnetic field, 16: 21658 (AD-265829)
design of plasma capacitor, 16: 21689(P)
PINCH EFFECT
angular momenta in Θ, canonial-kinetic negligible difference in, 16: 21681
2-PINENE
radiolysis yields, 16: 20497
2(10)-PINENE
radiolysis, polymer yields in, 16: 20498
PIPES
design of coaxial valved ducting for heat exchangers, 16: 20621(P)
flow in entrance region of parallel plate, wall slip, 16: 20620
steam-water flow through, 16: 20615
support device for cooling ducts in gas-cooled reactors, 16: 21781(P)
PLACENTAL TISSUES
strontium-90 content of human, 16: 20107
transmission of erythrocytes across mouse, radiation effects, 16: 20066
PLANETS
nitrogen abundance in Venus atmosphere, 16: 21228
PLANT CELLS
radiosensitivity of reproductive integrity in *Vicia faba*, 16: 20154
PLANTS
carbon-14 content with respect to geography, species, and time, 16: 20079
fission product uptake, effects of soil composition, 16: 20885
fission product uptake, effects of soil composition, 16: 20886
mutations induced by methane sulfonate and x radiation, 16: 20208
radiation damage to mitotic cells, protective effects of cysteamine, 16: 20219
radiation effects on mitotic index of *Vicia faba* tips, energy dependence, 16: 20212
radioactivity of weeds in Osaka, Japan, 1961, 16: 20121
radioinduced heritable mutations in rice, 16: 20180
radioinduced mutations in sweet potatoes, 16: 20178
radioinduced mutations in rice, 16: 20179
radiosensitivity of cultivated, relation to phylogenetic system, 16: 20169
uranium metabolism, 16: 20090
PLASMA
bibliography, 1953 to 1962, 16: 21660 (AD-271170)
compression and oscillation in theta pinch, 16: 21658 (AD-265829)
containment by d-c magnetic fields and external forces, 16: 21678
containment by periodic magnetic fields, 16: 21677
diagnostics in theta pinch, 16: 21669
electric conductivity, effects of seeding with low ionization potential substances, 16: 21663 (ARL-62-310)
electron and ion saturation currents in weakly ionized, at high pressures, 16: 21686
electron density measurement from optical refractivity, 16: 21673
electron removal from, free, 16: 21679
electron temperature of shock induced, 16: 21668(T) (AERE-Trans-893)
interactions with electromagnetic fields, 16: 21661 (AFCRL-746)
ion wave transmission in bounded, 16: 21674
kinetic equations for, 16: 21676
magnetic properties of relativistic, 16: 21675
motion in self consistent magnetic field, kinetic equations for, 16: 21672
oscillations of three-component, with or without magnetic field, 16: 21688
particle density and velocity determination, 16: 21671
perturbation stabilization in, by Coriolis force, 16: 21680
probe design for, wideband integrator, 16: 20661
production, design of hypersonic generator for, 16: 21139 (UNM-TR-EE-73)
properties in quasi-steady and steady states, 16: 21667 (TID-15504)
recombination of atomic ions and electrons in optically thin, 16: 21683
spectra of large-scale discharges, spectroscopic studies, 16: 21684
stability of cylindrical, with inhomogeneous cross-sectional distribution of current, 16: 21670
theory of equilibrium and non-equilibrium quantum, 16: 21664 (DI-82-0155)
thermodynamic equilibrium in spark, 16: 21687
transport equations for, 16: 21682
wave propagation in magnetic field with anisotropic pressure tensors for both components, 16: 21665 (NP-11649)
PLASMA JETS
evaluation and use as plasma source for space propulsion systems,

16: 21659 (AD-267135)
interactions with magnetic field produced by straight wire, 16: 20619
use in production of cyanogen, 16: 20392
uses in studies of high-temperature reactions, 16: 20391
PLATES
bibliography on all-metal sandwiches, 16: 20957 (NP-11677)
fluid flow of laminar boundary layer on flat, transitions in, 16: 20614
PLATINUM ISOTOPES Pt-196
gamma spectra, EO transition probabilities, 16: 21445
neutron reactions (n,γ), gamma spectra, 16: 21454
PLATINUM–SILICON SYSTEMS
heats of formation, 16: 20394
PLOWSHARE PROJECT
compressive stresses in Gnome shot, piezoelectric transducer measurements, 16: 20808 (PNE-105P)
core testing and grouting operations for Project Gnome, 16: 20046 (PNE-116F)
crater formation in desert alluvium in Project Stagecoach, 16: 20049 (SC-4596(RR))
ground motion measurements in Project Gnome, review, 16: 20872 (PNE-128F)
mine survey before and after Project Gnome, 16: 20048 (PNE-134F)
radiological safety on-site in Project Gnome, 16: 20873 (PNE-133F)
surface radiation and weather prediction for Gnome event, summary, 16: 20817 (PNE-126F)
survey of structures in Gnome event, 16: 20047 (PNE-127F)
PLUMBBOB OPERATION
monitoring, development of instruments for aerial, 16: 20647 (WT-1485)
PLUTONIUM
production by halide reduction in organic solvent, 16: 20533(P)
separation from elements with atomic numbers 89 to 95 by paper chromatography, 16: 20340
solvent extraction using TBP, 16: 20369(T) (AEC-tr-4457(p.161-6))
PLUTONIUM CHLORIDES
preparation and properties, 16: 20366(T) (AEC-tr-4457(p.10-19))
PLUTONIUM ISOTOPES Pu-237
content in hay in Germany, 1953 to 1961, 16: 20128
PLUTONIUM ISOTOPES Pu-239
neutron cross sections at 0.01 to 20 ev, 16: 21839(R) (IDO-16760)
PLUTONIUM ISOTOPES Pu-240
fission, probability of emission of long-range particles, 16: 21420
PLUTONIUM ISOTOPES Pu-242
fission, probability of emission of long-range particles, 16: 21420
PLUTONIUM(III) OXALATES
fluorination, effects of hydrofluoric acid-oxygen ratio, 16: 20354 (HW-19771)
PLUTONIUM OXIDE–THORIUM OXIDE SYSTEMS
fuel characteristics in boiling reactors, 16: 21736
PLUTONIUM(IV) OXIDES
fluorination, development of methods for, 16: 20298(R) (ANL-6477 (p.106-54))
POCKET CHAMBERS
development of 200-mr personnel dosimeter, 16: 20625(R) (AD-265927)
POLLEN
radiation effects on *Digitalis purpurea*, 16: 20142
POLONIUM ISOTOPES Po-206
production in thorium (p,αn) reactions at 155 Mev, cross sections, 16: 21374
POLONIUM ISOTOPES Po-207
production in thorium (p,αn) reactions at 155 Mev, cross sections, 16: 21374
POLONIUM ISOTOPES Po-208
production in thorium (p,αn) reactions at 155 Mev, cross sections, 16: 21374
POLONIUM ISOTOPES Po-210
production in thorium (p,αn) reactions at 155 Mev, cross sections, 16: 21374
POLYCYTHEMIA
treatment with phosphorus-32, 16: 20117
POLYMERIZATION
radiation chemistry, 16: 20483
radioinduced, effects of electric fields, 16: 20471 (NYO-9485)
radioinduced, use of gel point in determining, 16: 20523
radioinduced, uses for chemical dosimetry of electrons, gamma rays, and x rays, 16: 20857(R) (AD-265757)
POLYMERS
book: *Radiation Chemistry of Polymeric Systems*, Vol. XV, 16: 20522
radiation chemistry of cross-linking, grafting, and production, 16: 20483
radioinduced graft polymerization on industrial scale, 16: 20918(P)
POPULATIONS
radiotherapy, genetic effects of dermatological, 16: 20223
PORPHINES
synthesis of cobalt-57-labeled chelate of tetraphenylporphinesulfonate, 16: 20072
tumor localization of cobalt-57-labeled chelates, 16: 20072
PORTSMOUTH GASEOUS DIFFUSION PLANT, PORTSMOUTH, OHIO
monitoring of environs, 1961, 16: 20905
POSITRONS
annihilation in ice and water, 15-kgauss magnetic field effects, 16: 21175
decay in aluminum, half life, 16: 21439
emission in meson (π^+) decay, probabilities of, 16: 21321
lifetimes in metals, 16: 21201
localization of sources by coincidence counting, 16: 20076
polarization, 16: 21262 (CERN-62-8)
POTASH
mines survey at Carlsbad, New Mexico, before and after Project Gnome, 16: 20048 (PNE-134F)
POTASSIUM
content in rocks from eastern Greenland, 16: 20845
determination in chicken by neutron activation, 16: 20337
determination in rare earth oxides, spectrographic method for, 16: 20327
metabolism by erythrocytes in patients with cardiac insufficiency, 16: 20101
separation from rubidium and cesium using the heterotrihalides, 16: 20389
POTASSIUM (LIQUID)
thermodynamic and transport properties at 900 to 2100°F, 16: 21039(R) (NP-11671)
POTASSIUM BORATES
isotope exchange of deuterium and hydrogen in hydro-, 16: 20401
POTASSIUM BROMIDE CRYSTALS
electron-nuclear double resonance studies, 16: 21194
POTASSIUM BROMIDES
scintillation properties at low temperatures, 16: 20707
POTASSIUM CHLORIDE CRYSTALS
photoelectric effect in, at 20 to 500°C, 16: 21142(T) (CEA-tr-A-1087)
photoequilibrium between F and F' centers at 80°K, 16: 21193
radiation effects of electrons, 16: 21105
POTASSIUM CHLORIDES
corrosive effects on alloys and metals in chemical plants, 16: 20983
scintillation properties at low temperatures, 16: 20707
POTASSIUM CHLORIDES (LIQUID)
thermodynamics of magnesium, nickel, titanium, and zirconium in, oxygen equilibrium potential diagram for, 16: 20426
POTASSIUM COMPLEXES
with 3-cyanopentane-2,4-dione, stretching frequency of cyano group in, 16: 20421
POTASSIUM FLUORIDES
corrosive effects in aqueous solutions on Zircaloy-2, 16: 20977 (CRGR-1082)
diffusion of inert gases in, 16: 21048(T,R) (EURAEC-18)
POTASSIUM HALIDES
diffusion of argon in, 16: 21047(T,R) (EURAEC-17)
diffusion of argon in, 16: 21049(T,R) (EURAEC-121)
POTASSIUM HYDRIDES
system with potassium hydroxide, phase studies and thermal stability, 16: 20388
POTASSIUM HYDROXIDES
system with potassium hydride, phase studies and thermal expansion, 16: 20388
POTASSIUM IODIDES
scintillation properties at low temperatures, 16: 20707
POTASSIUM IONS
diffusion in bentonite clay-water pastes, self-, 16: 20425

exchange on natural and synthetic exchangers, 16: 20356 (JÜL-32-RC)
POTASSIUM ISOTOPES K-39
alpha reactions (α,n), positron decay of scandium-42 formed in, 16: 21636
proton reactions (p,γ), giant dipole resonances in, 16: 21511
POTASSIUM ISOTOPES K-40
determination in shore sand and sea silt, gamma-spectrometric, 16: 20323 (PG-Report-312)
POTASSIUM URANATES
formation in aqueous media, 16: 20385
POTATOES
radiation effects, acute gamma, 16: 20177
POTENTIOMETRIC ANALYSIS
equipment, 16: 20353(R) (EURAEC-241)
POWER PLANTS
space, effects of weightlessness in, 16: 21852
POWER REACTORS
cost calculation methodology, 16: 21828
description of fast, 16: 21732
design of boiling heavy water, 16: 21838(P)
design of gas-cooled high temperature, for ship propulsion, 16: 21826
economic aspects of small, 16: 21815 (NP-11706)
fuel containing thorium, feasibility, 16: 21736
materials, aluminum construction material survey, 16: 21829
regulation by steam output, 16: 21837(P)
site evaluation, 16: 20865 (DPR/INF/266)
PRASEODYMIUM IONS
spectra, time-resolved, 16: 20430
PRASEODYMIUM ISOTOPES Pr-141
decay, matrix elements and nuclear potentials in forbidden beta, 16: 21613
energy levels, lifetimes, 16: 21440
neutron reactions (n,2n), excitation functions for, 16: 21352 (NP-11667)
PRASEODYMIUM ISOTOPES Pr-142
nuclear moments and spectra, 16: 20305(R) (UCRL-10023)
PRASEODYMIUM ISOTOPES Pr-143
energy levels, lifetimes, 16: 21440
PRASEODYMIUM ISOTOPES Pr-144
decay scheme, 16: 20667
separation from waste solutions by flocculation, 16: 21862
PRASEODYMIUM NITRATES
crystal structure of hexahydrate, 16: 20443
PRASEODYMIUM OXIDES
analysis for impurities, spectrographic method for, 16: 20327
PREGNANCY
sodium-24 disappearance from uterus during normal and toxemic, 16: 20116
PRESSURE DROP
calculation for boiling reactors, computer code, 16: 20592(R) (EURAEC-264)
PRESSURE VESSELS
design for containers under gas pressure, 16: 21784(P)
design of prestressed concrete envelope, 16: 21766(P)
radiation effects on steel, 16: 21090(R) (EURAEC-140)
strength of thick-walled, theory for plastic pressure-deformation in material with directional properties, 16: 21735
stress concentrations at 70 to 1200°F, effects of reamed and threaded holes, 16: 21027 (DC-59-12-216)
thermal stresses in reactor, in vicinity of coolant inlet, 16: 21729
welding of support skirts to, 16: 21778(P)
PRESSURIZED WATER REACTORS
control rod actuator mechanism, 16: 21789(P)
fission product poisoning, uncertainties in predicted gross, 16: 21814 (KAPL-M-ECH-8)
PROMETHIUM ISOTOPES Pm-143
energy levels, 16: 20305(R) (UCRL-10023)
PROMETHIUM ISOTOPES Pm-147
diffusion in uranium (IV) oxides, 16: 21046(T) (AEC-tr-5171)
spectra, 16: 20305(R) (UCRL-10023)
PROPANE, 2-METHYL-
radiolysis with pulsed electrons, 16: 20305(R) (UCRL-10023)
1-PROPANOL
boiling on mercury and metal surfaces, nucleate, 16: 20618
radiolysis, effects of solute, 16: 20472(R) (RRL-79)
PROPENE
radiolysis in presence of xenon, 16: 20524(P)
PROPORTIONAL DETECTORS
calibration of converted Pee Wee for thermal neutrons, 16: 20640 (LAMS-2697)
description and performance of cosmic-ray, 16: 20626 (AD-269307)
design with reduced wall effect, 16: 20739
efficiency of boron trifluoride, 16: 20637 (JAERI-1030(Suppl.))
transistor circuits for remote boron trifluoride counters, 16: 20634 (DP-692)
PROPULSION
development of colloid, 16: 21856
development of electrostatic methods, 16: 21858
electric, review of developments in, 16: 21853
electrothermal systems for space, description of, 16: 21153
feasibility of arcjet, 16: 21854
ion, review of theory of surface ionization and uses, 16: 21846 (AD-268695)
ion, scale effects on performance, 16: 21851
ion systems for space, space-charge neutralization methods for, 16: 21152
plasma jet evaluation for spacecraft, 16: 21659 (AD-267135)
review of Kiwi, Rover, and SNAP systems, 16: 21857
space, effects of weightlessness on power systems in, 16: 21852
PROTACTINIUM
determination, spectrophotometric method using complex formation with thenoyltrifluoroacetone, 16: 20329
separation from elements with atomic numbers 89 to 95 by paper chromatography, 16: 20340
separation from hydrochloric acid, solution by solvent extraction with di-isopropyl carbinol and ketone, 16: 20451
PROTACTINIUM ISOTOPES Pa-227
excitation functions, 16: 21375
PROTACTINIUM ISOTOPES Pa-228
excitation functions, 16: 21375
PROTACTINIUM ISOTOPES Pa-230
excitation functions, 16: 21375
PROTACTINIUM ISOTOPES Pa-231
neutron total cross sections at 0.01 ev to 2 kev, tabulation, 16: 21349 (IDO-16698)
PROTACTINIUM ISOTOPES Pa-233
adsorption on vicor glass, 16: 20537(R) (ORNL-TM-177)
PROTECTIVE CLOTHING
fabrication of flexible plastic film for use as, 16: 20587(P)
PROTECTIVE OINTMENTS
therapeutic effects of steroid and antibiotic, in radioinduced skin lesions, 16: 20155
PROTEINS
calcium and strontium binding by blood serum, 16: 20111
effects of whole-body irradiation on serum, in rats, 16: 20287
effects of whole-body irradiation on lymph, 16: 20259
hemo-, oxidation and reduction by ultraviolet irradiation, 16: 20146
radiation effects on blood fractions and metabolism, prolonged small-dose, 16: 20188
radiation effects on crosslinking of desoxyribonucleic to, ultraviolet, 16: 20198
PROTON BEAMS
polarization, 16: 21262 (CERN-62-8)
PROTONS
angular distributions to excited 2+ and 3- states of nickel-58 and -60 at 39.7 Mev, parity change determinations from, 16: 21556
angular distributions and polarization in deuteron reactions (d,p) with carbon-12, effects of spin-orbit distortion, 16: 21599
angular distributions from nitrogen-14 reactions with fluorine-19 at 21.4 to 27.4 Mev, 16: 21625
detection and measurement, semiconductor detector systems for, 16: 20746
detection, computer program for telescopes for, 16: 20636 (ISS-61/17)
electron capture from atomic hydrogen by, 16: 21200
energy spectra from proton interactions with carbon and gold at 154 Mev,

16: 21488
interactions at 27 Bev, cross sections for elastic, 16: 21286
interactions with deuterons at 135 Mev, angular distributions and energy spectra of neutrons from, 16: 21475
interactions with protons at 30 to 100 Mev, polarization in, 16: 21486
interactions with hyperons (Λ) and mesons (K^0), elastic scattering, 16: 21264 (JINR-D-820)
interactions with neutrons at 27 Bev, cross sections for inelastic, 16: 21286
interactions with hyperons (Ξ^-) and ($\bar{\Xi}^+$), resonances from, 16: 21287
interactions with mesons (π^+), strange-particle production in, 16: 21289
interactions with mesons (π^-) at 1.0 Bev, angular distributions for elastic, 16: 21293
interactions with mesons (K^-), differential elastic cross sections, 16: 21309
interactions with electrons at large recoil angles and momenta, 16: 21313
interactions with antiprotons, meson (K^0) production in, 16: 21317
interactions with mesons (π^-) at 500 to 940 Mev, polarization, 16: 21323
interactions with mesons (μ), six nucleon form factors, 16: 21325
interactions with mesons (K^-), KΣN parity, 16: 21326
interactions with mesons (K^-), total cross sections at 630 to 1100 Mev, 16: 21360 (UCRL-10125)
mass difference with neutrons, meson (π) cloud effects on, 16: 21285
meson (π^-) capture, neutron emission at 8.9 Mev in, 16: 20683
polarization in deuteron reactions (d,p) with calcium-41, carbon-13, and magnesium-25 at 10.8 Mev, 16: 21581
polarization in deuteron stripping reactions at 15 Mev, effects of angle, 16: 21597
polarization in deuteron stripping reactions, effects of spin-orbit distortion, 16: 21600
polarization of recoil, in gamma-proton interactions at 725 and 900 Mev, 16: 21311
reactions (p,α) with nuclei at 18 Mev, seniority wave function effects on angular distributions and cross sections, 16: 21578
reactions (p,d) with cobalt-58 and iron-54 at 22 Mev, angular distributions from, 16: 21563
reactions (p,d) with iron-56, -57, and -58, deuteron spectra evidence of nucleus deformation in, 16: 21564
reactions (p,γ) on nuclei, gamma resonance effects, 16: 21452
reactions (p,γ) with phosphorus-31, resonances, 16: 21497
reactions (p,γ) with neon-22, resonances in, 16: 21498
reactions (p,γ) with nitrogen-15, excitation and giant dipole resonance in, 16: 21510
reactions (p,γ) with potassium-39, giant dipole resonances in, 16: 21511
reactions (p,γ) with aluminum, resonance energies in, 16: 21630
reactions (p,n) with mirror nuclei, angular distributions and excitation curves from, 16: 21582
reactions (p,n) with magnesium-26, Q-value measurement for, 16: 21615
reactions (p,n) with tritium, threshold energy, 16: 21630
reactions (p,nγ) with vanadium-51, cross sections and excitation functions, 16: 21626
reactions (p,p′γ) with carbon-12 at 150 Mev, excitation of 15.1 Mev level in, 16: 21481
reactions (p,p′γ) with neon-20, assignment of 4.97 Mev level from, 16: 21632
reactions (p,pn) and (p,2p) with carbon-12 at 120 to 150 Mev, gamma spectra of residual nuclei, 16: 21466
reactions (p,pn) with nuclei at 20 to 155 Mev, excitation functions for, 16: 21484
reactions (p,xn) with gold at 40 to 155 Mev, excitation functions of mercury isotopes from, 16: 21485
reactions (p,2p) with light nuclei at 150 Mev, binding energy and shell structure determination from, 16: 21487
reactions (p,2p) with carbon-12 at 155 Mev, momentum distribution of p and s protons in nucleus from, 16: 21489
reactions with carbon and gold at 154 Mev, deuteron, proton, and triton energy spectra from, 16: 21488
reactions with nuclei at 9 Bev, lithium-8 double emission in, 16: 21415
reactions with nuclei (Z = 4 to 50) at 32 Mev, neutron yields from, 16: 21479
scattering by atoms near 100 kev, ionization cross sections, 16: 21218
scattering by calcium-40 at 150 Mev, excited states from, 16: 21500
scattering by carbon-12 at 150 Mev, gamma and proton angular correlation in, 16: 21468
scattering by carbon and copper, shape of imaginary part of optical model potential in, 16: 21540
scattering by chromium, iron, and nickel at 2 to 5 Mev, resonances in, 16: 21543
scattering by copper at 9.4 Mev, polarization in elastic, 16: 21544
scattering by magnesium-24 at 10.7 Mev, angular correlations in inelastic, 16: 21561
scattering by nickel-60 at 31 Mev, cross sections for inelastic, 16: 21576
scattering by nuclei at 50 Mev, theoretical studies of alit, 16: 21639
scattering by nuclei at low energies, reaction mechanisms for inelastic, 16: 21393
scattering by samarium-154 and selenium-78 at 11 Mev, 16: 21504

PROTOZOA
radiation effects on trypanosome infection in rats, 16: 20256

PULSE ANALYZERS
charge-storage techniques for, 16: 20760
design and performance of a transistorized analog-to-digital converter, 16: 20758
design of a linear circuit for measuring the amplitude ratio of two pulses, 16: 20791
design of automatic data-taking system for, 16: 20778
design of devices for processing data from, 16: 20771
design of highly stable pulse-height discriminator, 16: 20782
design of memorizing circuit for long pulses, 16: 20804
design of multi-channel time analyzer with electrostatic memory tube for, 16: 20780
design of pulse-amplitude multipliers using logarithmic amplitude-to-time conversion, 16: 20798
design of pulse scaler using a new multi-stable system, 16: 20794
design of pulse shape discrimination, 16: 20786
design of 10 MHz transistorized pulse-height discriminator, 16: 20797
design of 16-channel, with high time resolution for multiple coincidence experiments, 16: 20775
design of 900-channel coincidence, 16: 20776
design, problems encountered in, 16: 20777
discrimination of pulses, linear method for, 16: 20784
discrimination of pulses, electronic methods for, 16: 20785
error reduction in amplitude-to-digital converters, 16: 20759
pulse-form discrimination in organic scintillation crystals, 16: 20788
pulse spectrum recording on the screen of a Williams tube used with ferrite-memory-type, multichannel, 16: 20761
random event-rate measurement based on a measurement of live-time, 16: 20793
signal-to-noise ratio in, theoretical expressions for, 16: 20627 (AEEW-R-132)

PULSE COLUMNS
development of air pulser for, 16: 20535(R) (IDO-14583)
operation of air-driven, 16: 20534(R) (IDO-14574)

PULSE MODIFIERS
design of transistor precision pulse shaper with short recovery time, 16: 20796
equipment for measuring the linearity and long-term stability of pulse amplifier gain, 16: 20783

PULSE TRANSFORMERS
use with radiation detectors, 16: 20789

PUMPS
performance of seals in heavy water operations, 16: 20564 (DP-666)

PUREX PROCESS
waste disposal by converting to phosphate glass, 16: 20042(R) (BNL-696)

PYRROLIDONE, VINYL- POLYMERS
radioinduced crosslinking, protective effects of sulfur against, 16: 20507

Q

QUANTUM ELECTRODYNAMICS
representation of spinors, 16: 21708
representation of integrals of motion, using displacement operators,

16: 21310
representations of generalized Dirac equations in general relativity, 16: 21701
QUANTUM MECHANICS
angular momenta in relativistic three-body system, 16: 21704
book: *Quantum Theory of Many-Particle Systems*, 16: 21223
canonical transformations in, 16: 21162
correction for self-interaction in the Thomas-Fermi potential, 16: 21212
ergodicity conditions in, formulation of, 16: 20940
ergodicity conditions by averaging methods, 16: 21172
general unitarity term, 16: 21702
generalization of, energy operator eigenvalues in, 16: 20941
lectures on relativistic, 16: 21699 (CERN-62-15)
magnetic properties of Bloch electrons, 16: 21176
matrix theory of waves, in general-relativistic, 16: 21709
new scattering approximation, 16: 21706
quaternion formulation of, 16: 21161
random-phase-approximation instability, for strong attractions, 16: 21148
random-phase-approximation instability, for strong attractions and strong short-range repulsions, 16: 21149
scattering theory analysis, 16: 21146
superselection principle and pure states of n-identical particles, 16: 21280
transport coefficients, perturbation calculation of, 16: 21166
transport coefficient relation to viscosity coefficients, 16: 21167
wave function admissibility condition derivations from, 16: 21163
QUARTZ
crystal structure, 16: 20380
properties evaluation for use in neutron activation analysis, 16: 20336

R

RABBITS
effects of irradiated head on body temperature, 16: 20279
mortality in short-duration overpressures, 16: 20864(R) (DASA-1242)
radiation effects on immunological response to lymph node cells, 16: 20275
radiation effects on skin graft take and immune response, 16: 20276
RADIATION
angular correlations of nuclear, measurement and uses, 16: 21351 (NP-11651)
biological effects on recovery from virus infection, 16: 20270
biological effects on antibody-forming cells in mice, 16: 20273
biological effects on biological systems, review of secondary, 16: 20291
biological effects on resistance of vaccinated rabbits to tuberculosis, 16: 20068
biological effects on hands, treatment, 16: 20136
biological effects, 16: 20142
biological effects, review, 16: 20898
biological effects on skin eczema, 16: 20163
biological effects in man, review, 16: 20181
biological effects on embryo intestine and testis, 16: 20186
biological effects on man, 16: 20240
biological effects of repeated, low-level exposure, 16: 20243
biological effects on enzymatic activity of regenerating liver in rat, 16: 20255
biological effects on rabbits infected with *Staphylococcus aureus*, 16: 20257
biological effects on serum beta-glucuronidase activity in cancer patients, 16: 20258
biological effects on lymph in rabbit, 16: 20259
biological effects on man, review, 16: 20261
biological effects of spleen irradiation on bone marrow characteristics, 16: 20262
biological effects on trypanosomiasis in rats, 16: 20256
carcinogenic effects on mammary glands in rats, effects of injected tumor fluid, 16: 20253
carcinolytic effects on cervical cancer, 16: 20057
carcinolytic effects on cervical cancer, 16: 20174
detection and measurement in biological materials, 16: 20904
dosage determinations for various organs from internally-administered radioisotopes, 16: 20152
dosage determinations for secondary cosmic rays, 16: 20240
dosage determinations, low-level, 16: 20243
dose to skin from radiologic examinations for congenital heart disease, 16: 20890
dosimetry, description of units for, 16: 20900
dosimetry in cardio-radiological diagnosis, 16: 20089
effects on adrenal medullary layer in rats, internal low dose, 16: 20191
effects on blood protein fractions and metabolism, prolonged small-dose, 16: 20188
effects on child of exposed parents clinical observation, 16: 20172
effects on erythropoiesis and iron-59 uptake by blood in pregnant mice, 16: 20190
effects on granulocyte peroxydases in normal and leukemic blood, 16: 20161
effects on mitotic index of *Vicia faba* tips, energy dependence, 16: 20212
effects on skin porosity during hibernation, 16: 20213
effects on survival of albino mice and rats, dietary deficiency effects on, 16: 20130 (NP-11741)
effects on virus infection and immunity, 16: 20227
emission from accelerated electrons, computation by traveling-wave technique, 16: 21281
magnetic rotation, theory, 16: 21159
pathological effects on skin, 16: 20132(T) (JPRS-13644)
pathological effects on lungs, 16: 20228
pathological effects of natural and fall-out, on humans, 16: 20229
protective effects of cysteamine against, 16: 20219
protective effects of fetal liver, spleen, and bone marrow cells against, 16: 20160
teratogenic effects on mouse fetus, 16: 20187
tolerance criteria for man in space flight, 16: 20882
transport equations, incorporation of error function absorption coefficient in, 16: 21328
use to produce heritable changes in rice, 16: 20180
RADIATION CHEMISTRY
book: *Radiation Chemistry of Polymeric Systems*, Vol. XV, 16: 20522
energy transfer in radiolysis, 16: 20491
radiolysis of water, kinetics and recombination of radicals in, 16: 20521
use in polymer cross-linking, grafting, and production, 16: 20483
RADIATION DAMAGE
mechanisms for displacement spike formation in metals, 16: 21106
RADIATION DETECTION INSTRUMENTS
conference, 16: 20757
conference, 16: 20706
correction for dead-time, automatic, 16: 20675
design for counting samples in sequence, 16: 20691(P)
design for counting successive samples, 16: 20700(P)
design for gas flow monitoring, 16: 20692(P)
design for identifying particles from nuclear reactions, 16: 20799
design for measuring radioactivity of air, 16: 20693(P)
design for monitoring air for long-lived activity, 16: 20694(P)
design of heat-insulated, for well logging, 16: 20697(P)
design of ionization-measuring, with tritium electron source, 16: 20702(P)
design of scintillation counter-ionization chamber combination for study of angular distribution of fission fragments, 16: 20736
design using frequency variation techniques, 16: 20644 (TID-15702)
performance, effects of unpurified carbon dioxide as filling gas, 16: 20668
production by United Industrial Research Institute, Taipei, 16: 20666
survey for use in clinical and biological studies, 16: 20904
use of image intensifiers with, for study of rare decay modes of elementary particles, 16: 20719
use of image intensifier tubes with, 16: 20721
RADIATION DETECTION INSTRUMENTS (ION CURRENT TYPE)
development of 200-mr personnel dosimeter, 16: 20625(R) (AD-265927)
RADIATION DETECTION INSTRUMENTS (PULSE TYPE)
auxiliary pulse transformer applications to, 16: 20789
calibration of time-to-pulse-height converters, 16: 21439
dead-time counting losses, new methods for continuously correcting, 16: 20792
design and performance of scintillation-type, system for indicating co-

ordinates of particle entry, 16: 20737
design and performance using cadmium sulfide crystals, 16: 20742
design and performance of helium-3-filled scintillation counter for neutron spectrometry, 16: 20710
design of a single-channel transistorized selector, 16: 20790
design of multi-pulse, using incrementally magnetized cores, 16: 20660
design of new circuits using E1T tubes, 16: 20802
design of pulse scaler using a new multi-stable system, 16: 20794
design of scintillation counter for neutrons with low gamma sensitivity, 16: 20787
design of scintillation-type, for slow neutrons and insensitive to gamma radiation, 16: 20718
design of xenon–helium filled scintillation-type, 16: 20715
discrimination between elementary particles in scintillation, linear method for, 16: 20784
discrimination of pulse shapes, electronic methods for, 16: 20785
discrimination of pulse shapes, apparatus for, 16: 20786
performance of scintillation-type, temperature effects on, 16: 20714
preamplifier for, high-voltage transistorized, 16: 20795
pulse-form discrimination in organic scintillation crystals, 16: 20788
pulse shaper for, design of transistorized short-recovery-time precision, 16: 20796
pulse transmission along a long cable with preamplifier and/or pulse transformer, 16: 20800
random event-rate measurement based on a measurement of live-time, 16: 20793

RADIATION DETECTORS
book: *Nuclear Radiation Detectors*, 16: 20689
efficiency, geometric effects on, 16: 20635 (ISS-61/7)

RADIATION EFFECTS
book: *The Effects of Nuclear Weapons*, 16: 20908

RADIATION EXPOSURE CHAMBERS
design of water-cooled in-pile, 16: 21737

RADIATION INJURIES
biological and chemical modification, reaction mechanisms in, 16: 20242
effects on oxygen metabolism in rabbits and rats, 16: 20192
necrosis after accidental exposure to x rays, case report, 16: 20184
protective effects of estradiol and testosterone in gamma-irradiated rats, 16: 20183
review of teratogenic effects of radiation, 16: 20210
skin, clinical morphology of surgical treatment, 16: 20278
to muscle, recovery reaction study with mechanical trauma, 16: 20166

RADIATION PROTECTION
bibliography, 16: 20859 (AERE-READING-LIST-8)
book: *Dosimetric and Special Technological Rules for Nuclear Power*, 16: 20903
measures used in industry, 16: 20894
methods on-site in Project Gnome, 16: 20873 (PNE-133F)

RADIATION SICKNESS
book: *Atlas of Pathological Anatomy of Acute Radiation Sickness in Experiment*, 16: 20295
effects on adaptation of bone marrow to incompatible mouse strain, 16: 20282
effects on anaphylaxis in guinea pig, 16: 20252
effects on blood platelets in mice, 16: 20277
effects on bone marrow and spleen, protective effects of desoxyribonucleic acid, 16: 20283
effects on enzymatic activity of regenerating liver in rat, 16: 20255
effects on gonads in male mice, protective effects of unsaturated fatty acid esters against, 16: 20285
effects on healing of burns and wounds in rats, 16: 20289
effects on hemoglobin formation in chicken, 16: 20260
effects on hemoglobin oxidation sensitivity in rat, 16: 20196
effects on liver in rat, effects of adrenal hormones, 16: 20247
effects on lymph in rabbit, 16: 20259
effects on mammary glands of rats, effects of injected tumor fluid, 16: 20253
effects on mice infected with lymphocytic choriomeningitis, 16: 20271
effects on mice infected with lymphocytic choriomeningitis, 16: 20272
effects on mouse fetus, malformations, 16: 20187
effects on ovary grafts in eyes of mice, 16: 20139
effects on oxidative phosphorylation in liver homogenates, in rats, 16: 20286
effects on pulmonary blood vessels, chronic, 16: 20189
effects on rabbits infected with *Staphylococcus aureus*, 16: 20257
effects on recovery from virus infection, 16: 20270
effects on resistance of vaccinated rabbits to tuberculosis, 16: 20068
effects on serum protein levels in rats, 16: 20287
effects on trypanosomiasis in rats, 16: 20256
effects on tumor metastasis in mice, 16: 20268
effects on ultraviolet-thrombopoietic factor in mice, 16: 20290
pathological effects on blood picture, 16: 20156(T)

RADIATION SOURCES
calibration, 16: 20904
counting rates required in tracer experiments, expression for, 16: 20488
design of cobalt-60, 16: 20586(P)

RADIATION TARGET CANS
fabrication for liquids to be irradiated, 16: 20574

RADIO WAVES
emission in elliptical galaxies, star formation as mechanism, 16: 21235
generation of white noise at 1 to 10 kc in exosphere, 16: 21231
transmission of 15 and 18 Mc, during ionospheric disturbances, 16: 21233

RADIOACTIVE CONTAMINATION
methods for removal of radioactive milk, 16: 20071
of sea foods and marine environment, review, 16: 20082

RADIOACTIVE MATERIALS
handling, chamber for, 16: 20585(P)
handling containers, density determination of wooden, 16: 20861 (AHSB(S)R-36)
handling, equipment designs and techniques for, 16: 20897

RADIOACTIVE MINERALS
prospecting, review of methods for aerial, 16: 20822

RADIOACTIVITY
book: *Natural Radioactivity*, 16: 20229

RADIOAPPLICATORS
dose distribution from interstitial, 16: 20112

RADIOAUTOGRAPHY
resolving power with tritium, 16: 20508
review, 16: 20054

RADIOBIOLOGY
book: *Aspects of Radiobiology*, 16: 20080
book: *Elements of Radiation Biochemistry*, 16: 20120
secondary effects on endocrine processes, 16: 20291

RADIOCHEMICAL PROCESSING PLANTS
filtration system for collecting radioactive aerosols, 16: 20575

RADIOCHEMISTRY
uses of electromigration and paper chromatographic methods in, 16: 20469 (NAS-NS-3106)

RADIODIAGNOSIS
of tumors, by localization of cobalt-57-labeled porphine chelates, 16: 20072
radiation dosage to various organs from internally-administered radioisotopes, 16: 20152
radiation dose to patients during medical examination, 16: 20211
radiation hazards in, review, 16: 20892
skin dose from examinations for congenital heart disease, 16: 20890
use of iodine-131 in children, possible harmful effects, 16: 20891
x-radiation, advantages of iron filters in, 16: 20086

RADIOFREQUENCY OSCILLATORS
use in measurement of radiation by frequency variation, 16: 20644 (TID-15702)

RADIOFREQUENCY SPECTROMETERS
use for delayed-coincidence electron spectra, 16: 21438

RADIOGRAPHY
dental, measurement of gonad radiation dose, 16: 20884
principles and techniques in industrial applications, 16: 20911

RADIOISOTOPES
deposition in soils, development of probe for, 16: 20850
deposition on reactor cooling system surfaces, 16: 21717 (DP-682)
determination of distribution as tracers in tissues, development of autoradiographic apposition method for, 16: 20338
determination of radioactive equilibrium in multimembered chains, 16: 21345 (AEET/HP/4)

development and production, 16: 20042(R) (BNL-696)
migration from solid to liquid phase of, formed by alpha disintegration, 16: 20373(T) (AEC-tr-4457(p.281-93))
monitoring in drinking, river, and waste waters, Prague, 16: 20878(T) (AECL-1498)
radiation protection in using, bibliography on, 16: 20859 (AERE-READING-LIST-8)
transportation, methods used in, 16: 20896
use in dating commercial products, 16: 20909 (TID-15034)
use in mechanical engineering problems, survey, 16: 20916
use in radiomutography, review, 16: 20054
uses, 16: 20041(R) (BMI-1574(Del.))
uses in determination of ages of elements, galaxy, solar system, and universe, 16: 21606
uses in instrument engineering, 16: 20912
uses in measuring weight of ammunition primer compositions in assembled primer cups, 16: 20917
uses in transducers for indicating very small displacements, 16: 20913

RADIOLOGY
radiation dose to patients, 16: 20211
radiation measurement in medical, description of units for, 16: 20900
skin dose from examinations for congenital heart disease, 16: 20890

RADIOMIMETIC SUBSTANCES
use of intermediate oxidation products of oleic acid to produce effects on yeast cells similar to action of gamma radiation, 16: 20063

RADIOSENSITIVITY
of cultivated plants, relation to phylogenetic system, 16: 20169
of *Escherichia freundii*, protective effects of fluoroacetate against, 16: 20144
of reproductive integrity of plant cells, 16: 20154
of roots of *Vicia faba* seedlings, dose-response relationship, 16: 20153
of spleen cells in mice, 16: 20274

RADIOSTERILIZATION
of foods, effectiveness in control of spoilage by *Clostridium botulinum*, 16: 20914
of seeds, effects on enzyme activity, 16: 20915

RADIOTHERAPY
cervix, thyroid iodine levels after, 16: 20102
curability of cutaneous and uterine sarcomas, 16: 20092
dose differences in interstitial, with radium needles, 16: 20093
dose distribution in interstitial implant, use of computer in computation of, 16: 20112
facility design for whole-body cobalt-60, 16: 20078
field control by film radiography, 16: 20088
field positioning with photographic film techniques, 16: 20087
of cancer, effects on serum beta-glucuronidase activity, 16: 20258
of cervical cancer, response, 16: 20057
of cervical cancer, resistance, 16: 20174
of cervix carcinomas, effects on excretion of various substances, 16: 20254
of multiple myeloma using injected yttrium-90, 16: 20070
of ovarian carcinomas, 16: 20141
of rheumatoid arthritis, distribution of gold-198 in body, 16: 20083
of uterine carcinoma, effects on blood, 16: 20264
of uterine cervix cancer, effects on endometrium, 16: 20158
radiation dosage to various organs from internally-administered radioisotopes, 16: 20152
sarcoma induction by brain, 16: 20171
uses in dermatology, radiation damage to population from, 16: 20223
with x radiation, reduction of scatter radiation, 16: 20569

RADIUM
determination in monazites polarographic, 16: 20325(T) (NP-tr-895)
dose distribution from interstitial implantations, computer method for determining, 16: 20112

RADIUM ISOTOPES
migration from solid to liquid phase, 16: 20373(T) (AEC-tr-4457(p.281-93))

RADIUM ISOTOPES Ra-222
energy level at 111 kev, lifetime, 16: 21434

RADON ISOTOPES Rn-220
measurement in air, 16: 20848

RADON ISOTOPES Rn-222
measurement in air, 16: 20848

RAIN WATER
analysis for cerium-144 at Westwood, New Jersey, July 1960 to June 1961, 16: 20816 (NYO-9531)
radioactivity in Japan, July to Sept. 1961, 16: 20129
radioactivity in Osaka, Japan, 1961, 16: 20121
sampling, drop-size recorder design, 16: 20565 (HW-73119)

RARE EARTH COMPOUNDS
luminescence, existence of quasi-linear, 16: 20378(T) (AEC-tr-5112)

RARE EARTH IONS
properties, magnetic and spectroscopic investigation, 16: 21128 (MRL-118)

RARE EARTH MINERALS
analysis of Ural mountain peritotite, 16: 20835

RARE EARTH SELENIDES
thermoelectric properties, 16: 21015(R) (AD-266116)

RARE EARTH SULFIDES
thermoelectric properties, 16: 21015(R) (AD-266116)

RARE EARTH TELLURIDES
thermoelectric properties, 16: 21015(R) (AD-266116)

RARE EARTHS
corrosion, effects of phosphorus, 16: 20971(R) (AD-266150)
determination in chondrites and sediments, activation, 16: 20841
electronic 4f wave functions, and atomic radii, 16: 21212
energy levels, atomic beam measurements, 16: 20305(R) (UCRL-10023)
nuclear magnetic moments, 16: 21388
passivation of metal surfaces, 16: 20970(P)
phase studies, design of arc melting furnace for, 16: 20989 (ASD-TN-61-32)
reactions with EDTA in aqueous solution, calorimetric studies, 16: 20402
separation by cation exchange, 16: 20554(P)
separation by column chromatography using di(2-ethylhexyl) orthophosphoric acid-treated cellulose powder, 16: 20546
separation by ion exchange, effects of resin exchange capacity and structural rigidity, 16: 20371(T) (AEC-tr-4457(p.187-9))
separation from minerals by ion exchange methods, 16: 20543
separation from monazites, 16: 20343
separation using anion-exchange resins and EDTA, elution behavior of scandium in, 16: 20549

RARE GASES
diffusion in potassium fluoride, thorium dioxide, uranium carbides, and uranium dioxide, 16: 21048(T,R) (EURAEC-18)
spectra of crystalline, line shape of ultraviolet absorption, 16: 20417
sputtering reactions with metals, yields from, 16: 21114(R) (AD-267458)
sputtering reactions with metals, yields at low energies, 16: 21116 (AD-267458(Pt.V))
treatment for chemical combination, 16: 20580(P)

RATE METERS
design of high-gain for use with remote boron trifluoride neutron counters, 16: 20634 (DP-692)
design of simple logarithmic, 16: 20803

RATS
distribution and excretion of labeled perphenazine in, 16: 20084
hypophysectomized, effects of combined x irradiation and sex hormone treatment, 16: 20185
lethal radiation dosage measurements, 16: 20131 (UR-575)
mortality in short-duration overpressures, 16: 20864(R) (DASA-1242)
radiation effects on survival of albino, effects of dietary deficiencies on, 16: 20130 (NP-11741)
radiation effects on urinary excretion of noradrenalin or adrenalin, 16: 20173
radiation effects on adrenal medullary layer, 16: 20191
radiation effects on alterations in deoxyribonucleic acid from regenerating liver, *in vivo*, 16: 20199
radiation effects on testes, comparison of single and fractionated doses, 16: 20225
radiosensitivity effects of oxygen in x-irradiated, 16: 20280
radiosensitivity of tumors, 16: 20131 (UR-575)

REACTION MECHANISMS
kinetics, effects of isotope exchange, 16: 20361 (TID-15788)
rate constants, calculation from transition-state theory, 16: 20418

REACTIVITY MEASUREMENT FACILITY
fuel and poison weighting functions in advanced, 16: 21839(R) (IDO-16760)
REACTOR BREEDING ELEMENTS
processing thorium, for separation of uranium-232, 16: 20924 (TID-15054)
REACTOR COMPONENTS
cleaning, packing, and transportation, 16: 20896
development for civilian applications, 16: 20041(R) (BMI-1574(Del.))
REACTOR CONTROL ELEMENTS
radiation effects on candidate matdrials, 16: 21094 (NP-11708)
REACTOR CONTROL RODS
drive mechanism for pressurized water reactors, 16: 21789(P)
drive with means for holding rods in shutdown position, 16: 21773(P)
efficiency of arbitrary configuration in homogeneous cylindrical reactor, flux denting measurement, 16: 21740
REACTOR CONTROL SYSTEMS
analysis, use of dynamic models in, 16: 21713 (AEEW-R-121)
design criteria for, 16: 21724 (NP-11701)
design for changing power level, 16: 21790(P)
design of shutdown device using balls, for gas-cooled reactors, 16: 21755(P)
design of shutdown device using balls, for gas-cooled reactors, 16: 21756(P)
design using tubes in core, 16: 21764(P)
design with filler members for startup of boiling water-moderated reactors, 16: 21787(P)
development, 16: 2718(R) (GEMP-72)
performance, effects of poison levels, 16: 21738
stability, investigation of nonlinear, 16: 21731
REACTOR COOLANTS
development of organic, status report, 16: 21818 (TID-14978)
flow and temperature distribution in free convection fuel matrix designs, 16: 21720 (KAPL-M-PF-6)
flow control device for gas-cooled graphite-moderated reactors, 16: 21785(P)
REACTOR COOLING SYSTEMS
design of safety valve for contaminated gases, 16: 21761(P)
duct support device for gas-cooled, 16: 21781(P)
fission product detection in gas-cooled, apparatus, 16: 21776(P)
fission product detection in gas-cooled, device, 16: 21782(P)
fission product detection for jacket bursts, apparatus, 16: 21783(P)
fission product detection in gas-cooled, device for short-lived, 16: 20692(P)
gag valve device for control of flow to hot box in gas-cooled reactors, 16: 21750(P)
REACTOR ENGINEERING
conference on nuclear superheat projects, 16: 21817 (TID-7630)
research progress at Argonne National Lab., October to December 1961, 16: 20296(R) (ANL-6477)
REACTOR FUEL ELEMENTS
burnup analysis, 16: 21734
cladding with beryllium and beryllium alloys, 16: 20962
coolant, free convection flow calculation, 16: 21720 (KAPL-M-PF-6)
design of cluster assemblies for efficient cooling, 16: 21767(P)
design of coiled, 16: 21772(P)
design of plate assembly with cavities for absorbing fission gases, 16: 21765(P)
design of plate assembly for organic-moderated reactors, 16: 21770(P)
design of splitter fin body for finned, 16: 21779(P)
design with demountable coupling, 16: 21771(P)
design with sleeve for gas-cooled reactors, 16: 21777(P)
development for civilian applications, 16: 20041(R) (BMI-1574(Del.))
development for organic moderated reactors, 16: 21818 (TID-14978)
end plug design with reinforcing member, 16: 21759(P)
fabrication and testing of uranium–zirconium (zirconium clad), 16: 21001
failure detection apparatus for gas-cooled reactors, 16: 21776(P)
failure detection apparatus, 16: 21783(P)
failure detection by scanning, position-indicating device, 16: 20577(P)
failure detector for gas-cooled reactors, 16: 21782(P)
heat transfer of cylindrical, 16: 21712 (AEEW-R-96)
heterogeneity corrections in, computer program for determining, 16: 21721 (MND-C-2500-2)
materials reactions in, factors influencing rates and zone structure, 16: 20964
neutron flux distribution, monoenergetic treatment, 16: 21344
processing of irradiated, progress on Eurochemic program, 16: 20539(R) (ORNL-TM-246)
storage of irradiated, pond facility, 16: 21788(P)
temperature and heat current distribution in reversed and direct coolant flow, 16: 20600
REACTOR FUEL ELEMENTS (CERAMIC)
fabrication, 16: 20960 (ORNL-3225)
fabrication and radiation effects, uranium carbide development, 16: 20998(T,R) (EURAEC-220)
fabrication and radiation effects, 16: 20999(T,R) (EURAEC-247)
fabrication dense uranium oxide, 16: 21819 (TID-15373)
REACTOR FUEL ELEMENTS (DISPERSION)
design and fabrication of autogenous cellular matrix, 16: 21005(P)
REACTOR FUEL PLATES
fabrication of assembly, 16: 21004(P)
REACTOR FUEL RODS
development for water-cooled reactors, 16: 20951(R) (CEND-149)
REACTOR FUEL TUBES
criticality limits for I and E, 16: 20867 (HW-70351(Rev.))
development of double annulus, for superheaters, 16: 21812(R) (GNEC-230)
forging of extruded uranium, 16: 20993 (NLCO-842)
REACTOR FUELS
conference on nuclear superheat projects, 16: 21817 (TID-7630)
development, 16: 21794(R) (ANL-6565)
development for civilian applications, 16: 20041(R) (BMI-1574(Del.))
post-irradiation examination, description of facilities at Windscale for, 16: 21089 (DPR/INF/265)
processing, development of methods and facilities for, 16: 20297(R) (ANL-6477(p.29-105))
processing of spent, 16: 20541(T,R) (EURAEC-24)
radiation effects on candidates for MGCR, 16: 20041(R) (BMI-1574(Del.))
reprocessing, chlorination method, 16: 20552
REACTOR MATERIALS
characteristics of beryllium and beryllium oxide, 16: 20962
cleaning, packing, and transportation, 16: 20896
compatibility studies, 16: 20964
development, 16: 21794(R) (ANL-6565)
development for civilian applications, 16: 20041(R) (BMI-1574(Del.))
quality standards and specifications, 16: 21742
REACTOR MATRICES
criticality studies of multitube, 16: 21812(R) (GNEC-230)
REACTOR MODERATORS
design of graphite, for sealed cooling ducts, 16: 21760(P)
design of graphite, for stabilized lattice spacing, 16: 21769(P)
design of graphite block assembly with spacers to prevent channel misalignment due to irradiation, 16: 21775(P)
fast neutron penetration effects, 16: 21337
neutron scattering, data analysis scheme, 16: 21332 (AERE-R-4041)
REACTOR SAFETY
analysis of fast and thermal systems, 16: 21794(R) (ANL-6565)
distance factors for power and test reactor sites, calculation method, 16: 21726 (TID-14844)
economic aspects, financial effects of nuclear insurance rates, 16: 21733
hazards evaluation for Spectral Shift Control Reactor, 16: 20863 (BAW-1215(& Suppl.1))
metal oxidation and ignition and metal-water reaction studies, 16: 20300(R) (ANL-6477(p.168-203))
research progress at Argonne National Lab., October to December 1961, 16: 20296(R) (ANL-6477)
site evaluation for power reactors, 16: 20865 (DPR/INF/266)
REACTOR SHIELDING
design and calculation of biological, 16: 21696
design of internal, with shielded coolant passages for gas-cooled reactors, 16: 21747(P)
design of prestressed concrete envelope, 16: 21766(P)
REACTOR SIMULATORS

use in design, 16: 21833
REACTORS
control by coolant flow pulsations, 16: 21763(P)
coolant flow baffle body design to prevent faulty replacement, 16: 21762(P)
design and theory development, 16: 20042(R) (BNL-696)
design of multi-jacketed core, 16: 21780(P)
development in Australia, 16: 20044 (NP-11606)
development, physics research, 16: 21794(R) (ANL-6565)
instrumentation development, 16: 21718(R) (GEMP-72)
loading and unloading, hoist with means for connection of thermocouple leads on fuel elements, 16: 21753(P)
neutron flux measurements using semiconductor detectors, 16: 20754
neutron transport equation, Yvon's approximation method for solving, 16: 21336
poisoning of high-flux, effects on shutdown behavior, 16: 21738
poisoning, representation of xenon on phase-plane, 16: 21741
pressure vessels, stationary thermal stresses in vicinity of coolant inlet, 16: 21729
probability densities of one-velocity bare, 16: 20592(R) (EURAEC-264)
refueling machine design with emergency equipment for fault conditions, 16: 21749(P)
refueling machine, drive transmission for hoist, 16: 21751(P)
refueling machine design with removable shielding, 16: 21752(P)
siting high-flux experimental, hazards analysis, 16: 21744
stability, investigation of nonlinear, 16: 21731
support of core and heat exchanger for relative thermal expansion, 16: 21746(P)
REDUCTION
analysis of gases generated in dingot-bomb, 16: 20525(R) (MCW-1472)
REFRACTORY MATERIALS
properties of alloys at high temperatures, 16: 20954(R) (NMI-2104)
RELATIVITY THEORY
energy localization and gravitation quantization in general, 16: 21144
matrix theory of waves, 16: 21709
representations of generalized Dirac equation in general, 16: 21701
wave solutions in general, 16: 21207
REMOTE-CONTROL EQUIPMENT
design and performance of manipulators, tongs, and welder-cutter, 16: 20897
design for indicating position of faulty fuel elements in reactor, 16: 20577(P)
design for loading and unloading irradiation channels in reactor, 16: 20582(P)
viewing, performance survey of remote-viewing equipment, 16: 20562 (DC-60-8-32)
REMOTE-VIEWING EQUIPMENT
performance survey for remote-handling operations, 16: 20562 (DC-60-8-32)
RESEARCH REACTORS
critical experiment in Polish VVR-S "EWA", 16: 21842
description of fast, 16: 21732
design and characteristics of closed-cycle water-boiler, 16: 21786(P)
design and uses of Siemens Training reactor, 16: 21840
design of Argonne Thermal Source Reactor, 16: 21714 (ANL-6440)
design of fail-safe low-power, 16: 21843
experimental facilities for Russian IRT-2000, organic loop, 16: 21841
fuel element burnup analysis of Soris swimming pool, 16: 21734
RESPIRATION
determination of carbon-14-labeled carbon dioxide, apparatus, 16: 20326
RHENIUM
emission behavior in plasma diodes, 16: 21138 (UCRL-6809)
RHENIUM ISOTOPES
nuclear gyromagnetic ratios and quadrupole moments, 16: 21446
RHENIUM ISOTOPES Re-187
beta decay and half life, 16: 21405
energy levels, properties of 686-kev, 16: 21383
RHENIUM SILICIDES
heats of formation, 16: 20394
RHENIUM–TANTALUM ALLOYS
hardness and tensile properties, 16: 20955(R) (NMI-2105)
RHODIUM ISOTOPES Rh-103
photon scattering at 4 to 24 Mev, cross sections for inelastic, 16: 21641
RHODIUM ISOTOPES Rh-106
determination in shore sand and sea silt, gamma-spectrometric, 16: 20323 (PG-Report-312)
separation from waste solutions by flocculation, 16: 21862
RHODIUM–SILICON SYSTEMS
heats of formation, 16: 20394
RHODIUM–TANTALUM ALLOYS
phase studies, 16: 21036(R) (NMI-9235)
RHODIUM–TUNGSTEN ALLOYS
phase studies, 16: 21036(R) (NMI-9235)
RIBONUCLEIC ACID
physical properties, effects of ultraviolet radiation, 16: 20150
RIBONUCLEIC ACID, DESOXY-
biological effects of labeled, 16: 20515
content in infected HeLa cells, problem on nucleotide pool size in experiments with tritiated thymidine, 16: 20104
length in T2 bacteriophage, 16: 20096
protective effects against radiation in bone marrow and spleen, 16: 20283
radiation effects on alterations in, from regenerating rat liver, *in vivo*, 16: 20199
radiation effects on strand separation and recombination, 16: 20193
radiation effects on crosslinking to protein, ultraviolet, 16: 20198
radioinduced free radicals, electron spin resonance, 16: 20195
replication in phage-infected *E. coli*, 16: 20095
synthesis in leukocytes, effects of nitrogen mustard, 16: 20062
ROCKET MOTORS
description of electrothermal, 16: 21153
ROCKET REACTORS
development and shielding, 16: 20236
ROCKET REACTORS (KIWI)
development, review, 16: 21857
ROCKET REACTORS (TORY)
design of II-A, aero-thermodynamic and mechanical, 16: 21822 (UCRL-6305)
ROCKETS
performance of optimized multistage, 16: 21848 (LA-2677)
propulsion by electrostatic devices, 16: 21858
ROCKS
analysis of standard G-1 and W-1 for trace elements, activation, 16: 20830
analysis of standard G-1 and W-1 for trace elements, spectrographic, 16: 20831
potassium-argon ages, from eastern Greenland, 16: 20845
ROCKY FLATS PLANT, DENVER
monitoring of environs, 1961, 16: 20907
ROOTS
radiosensitivity in *Vicia faba*, dose-response relationship, 16: 20153
RUBBER
radioinduced vulcanization, effects of coumarone-indene resin additive, 16: 20481
RUBIDIUM
hyperfine structure, 16: 21129(R) (NP-11640)
separation from cesium and potassium using the heterotrihalides, 16: 20389
separation from strontium by isotope dilution, 16: 20332
RUBIDIUM BROMIDES
scintillation properties at low temperatures, 16: 20707
RUBIDIUM FLUOBERYLLATES
crystal structure, relation to silicate sheet structures, 16: 20440
RUBIDIUM IODIDES
scintillation properties at low temperatures, 16: 20707
RUBIDIUM IONS
exchange on natural and synthetic exchangers, 16: 20356 (JÜL-32-RC)
RUBIDIUM ISOTOPES Rb-86
beta decay, matrix elements for forbidden, 16: 21409
RUBIDIUM NITRATES
hydrolysis of aqueous solutions, acid extraction by amine, 16: 20434
RUSSIAN REACTORS
design of BR-I and BR-V, 16: 21732
RUTHENIUM

ion exchange on Radgendorf clay, 16: 21865
RUTHENIUM COMPOUNDS
ammine-, preparation and composition of complexes with phosphate group, 16: 20422
RUTHENIUM ISOTOPES Ru-102
oxygen ion reactions, Coulomb excitation by, 16: 21517
RUTHENIUM ISOTOPES Ru-103
content in drinking waters in England, 16: 20126
determination in shore sand and sea silt, gamma-spectrometric, 16: 20323 (PG-Report-312)
sorption by stainless steel in boiling-water reactor, 16: 20303(R) (ANL-6477(p.224-30))
RUTHENIUM ISOTOPES Ru-104
oxygen ion reactions, Coulomb excitation by, 16: 21517
RUTHENIUM ISOTOPES Ru-106
determination in seaweed, effects of sample ashing at 450 to 500°C on, 16: 20322 (PG-Report-122)
determination in shore sand and sea silt, gamma-spectrometric, 16: 20323 (PG-Report-312)
separation from waste solutions by flocculation, 16: 21862
RUTHENIUM SILICIDES
heats of formation, 16: 20394
RUTHENIUM–TANTALUM ALLOYS
hardness and tensile properties, 16: 20955(R) (NMI-2105)
RUTILES
chlorination in carbon mixtures, radiation effects, 16: 20468 (BM-RI-5994)
RUTIN
solvent properties for thorium, 16: 20427

S

SACLAY REACTORS (PROSERPINE)
reactivity, and effectiveness of delayed neutrons, 16: 21739
SAFETY
book: *The Effects of Nuclear Weapons*, 16: 20908
code of practice against radiation hazards, 16: 20902
SAFETY HAZARDS
analysis in siting high-flux experimental reactors, 16: 21744
control, development of equipment and methods for, 16: 20875(R) (UCRL-6818)
in radiodiagnosis, review, 16: 20892
review of assessment of radiation, 16: 20898
SALIVARY GLANDS
radiation effects, histological modifications in testicles induced by, 16: 20216
radiation effects, histological modifications in ovaries induced by, 16: 20217
SAMARIUM
specific heat at 0.4 to 4°K, 16: 21189
SAMARIUM ETHYL SULFATES
spin-lattice relaxation time, 16: 21188
SAMARIUM ISOTOPES
nuclear gyromagnetic ratios and quadrupole moments, 16: 21446
SAMARIUM ISOTOPES Sm-150
energy levels, 16: 21396
SAMARIUM ISOTOPES Sm-152
energy levels, g values of first excited states, 16: 21505
gamma spectra, E2 emission parameters, 16: 21444
SAMARIUM ISOTOPES Sm-154
deuteron and proton scattering at 11 Mev, 16: 21504
gamma spectra, E2 emission parameters, 16: 21444
SAMPLING
device design for raindrops, 16: 20565 (HW-73119)
SANDS
analysis for radionuclides, gamma-spectrometric, 16: 20323 (PG-Report-312)
SAPPHIRES
crystal structure of synthetic, 16: 20380
SARCOMAS
radioinduced in frontal bone by cerebral tumor therapy, 16: 20171
radiotherapy of cutaneous and uterine, 16: 20092
SATELLITES
cosmic radiation measurements from Explorer VI and Pioneer V with proportional counter telescope, 16: 20626 (AD-269307)
energetic particle studies by Explorer XII, data summary, 16: 20851
nuclear power plants for, 16: 20236
power systems, effects of weightlessness on, 16: 21852
use in detection and identification of high-altitude nuclear explosions, 16: 20854
use in detection and identification of high-altitude nuclear explosions, 16: 20855
SAVANNAH RIVER COMPONENTS TEST REACTOR
criticality studies, 16: 21810(R) (DP-725)
SAVANNAH RIVER PLANT
monitoring of environs, 1961, 16: 20905
SCALERS
design and performance using transistor-driven decade counter tubes, 16: 20801
design of 50-kc transistorized decade, 16: 20676
time coding with binary, 16: 20769
SCANDIUM
behavior in separation of rare earths using anion-exchange resins and EDTA, 16: 20549
determination as trace in standard rocks G-1 and W-1, spectrographic, 16: 20831
SCANDIUM IONS
exchange on natural and synthetic exchangers, 16: 20356 (JÜL-32-RC)
SCANDIUM ISOTOPES Sc-42
decay, one-minute positron activity in, 16: 21636
SCANDIUM ISOTOPES Sc-44
decay, beta-gamma circular-polarization correlation and isospin conservation in, 16: 21616
SCANDIUM ISOTOPES Sc-45
proton reactions (p,α) at 18 Mev, seniority wave function effects on angular distributions and cross sections, 16: 21578
SCANDIUM ISOTOPES Sc-46
decay, beta-gamma circular-polarization correlation and isospin conservation in, 16: 21616
SCANDIUM OXIDE–SILICON OXIDE SYSTEMS
phase studies and properties of scandium silicates in, 16: 20444
SCATTERING
amplitude analyticity in complex angular momentum of relativistic S-matrix, 16: 21698 (AFOSR-2400)
amplitude imaginary component, channel-spin contribution analyticity, 16: 21294
amplitudes for nucleons, field theoretical derivation, 16: 21402
amplitudes, kinematic branch points of n-line graphs, 16: 21208
angular momentum in, maximum analyticity application to, 16: 21306
book: *S-Matrix Theory of Strong Interactions*, 16: 21329
cross sections, analytic properties of partial differential, 16: 21290
dispersion relations, axiomatic formulation of, 16: 21307
new scattering approximation method, 16: 21706
Regge trajectories for single attractive Yukawa potential, 16: 21268 (UCRL-10140)
S matrix holomorphy domain in potential, 16: 21295
S matrix left-hand cut discontinuity and equivalent potentials, 16: 21297
singular wave function operator application in, 16: 21279
theory, lectures on non-relativistic, 16: 21260 (AFOSR-2409)
theory, quantum mechanical analysis, 16: 21146
transition matrix for scattering of free particles by systems of identical bound particles, 16: 21312
unitarity properties, for case of two possible reactions, 16: 21702
SCHISTOSOMA
radiation effects on *S. mansoni* cercariae, use to immunize monkeys, 16: 20202
SCINTILLATION DETECTORS
design and performance, system for indicating particle entry, 16: 20737
design and performance using organic scintillators, 16: 20708
design and performance of liquid, for neutrons, 16: 20709
design for slow neutrons and insensitive to gamma radiation, 16: 20718
design modifications for measurement of absorbed electron dose, 16: 20688
design of xenon–helium filled, 16: 20715

development for use in image intensification of weak beams, 16: 20642 (NP-11663)
development status, 16: 20641 (NP-11616)
performance in delayed-coincidence applications, 16: 21434
performance in gamma spectrometer, 16: 20628 (ANL-6499)
performance of plastic phosphor well-type, for counting biological samples, 16: 20658
performance, temperature effects on, 16: 20714
preparation and scintillation efficiency of plastic, for thermal neutrons, 16: 20717
response of thallium-activated sodium iodide crystals to gamma rays and electrons, nonproportional, 16: 20713
response to alpha particles and fission products, use of thallium-activated cesium iodide foils, 16: 20669
use in aerial prospecting for radioactive minerals, 16: 20822
use of image intensifier system with, 16: 20720
SEA WATER
analysis of silt containing for radionuclides, gamma-spectrometric, 16: 20323 (PG-Report-312)
cesium-137 content in Osaka Bay, Japan, 16: 20123
radioactivity of Osaka Bay, Japan, 1961, 16: 20121
SEALS AND GLANDS
performance in heavy water pumps, 16: 20564 (DP-666)
SEED
radiation effects on survival and germination, 16: 20167
SEEDLINGS
radiosensitivity of roots in *Vicia faba*, dose-response relationship, 16: 20153
SEISMOLOGY
use in detection and identification of underground nuclear explosions, 16: 20854
use in detection and identification of underground nuclear explosions, 16: 20855
SELENIUM
electron and hole drift mobilities and space-charge-limited currents in, effects of arsenic, 16: 21018 (AFOSR-1416)
SELENIUM ISOTOPES Se-78
deuteron and proton scattering at 11 Mev, 16: 21504
SELENIUM ISOTOPES Se-81
yield from neutron fission of uranium-235, 16: 21347 (AWRE-0-58/61)
SEMICONDUCTOR DETECTORS
design and performance of surface-barrier-type, for nuclear reaction studies, 16: 20744
design and performance for detection and mass identification of protons, deuterons, tritons, helium-3, and alpha particles, 16: 20746
design and performance for neutrons, 16: 20755
design and performance for measurement of dE/dx and total energy of nuclear reactions, 16: 20747
design and use for measuring reactor neutron flux distribution, 16: 20754
energy resolution in, electrical limitations to, 16: 20756
neutron-induced background processes in, 16: 21527
operation, 16: 20629 (BNL-699)
performance, 16: 20743
performance, 16: 20750
performance as charged-particle and neutron spectrometers, 16: 20752
performance in nuclear pulse-height spectroscopy, 16: 20753
performance status of silicon junction, 16: 20674
preparation and application to the detection of relativistic particles, 16: 20748
preparation and performance of ionization chamber using, 16: 20749
use in associated particle techniques, 16: 21130(R) (NP-11643)
SEMICONDUCTORS
book: *Solid State Physics. XIII.*, 16: 21221
book: *Solid State Physics. XI.*, 16: 21222
electric and optical properties, 16: 21010(R) (AD-264878)
electron gas at high temperatures in, perturbative effects, 16: 21217
ionized impurity scattering in degenerate, application of variational technique in the partial-wave method, 16: 21195
preparation and properties of refractory metal, 16: 21111(R) (AD-265106)
properties, determination by microwaves, 16: 21010(R) (AD-264878)
radiation effects on, coated with antimony-activated tin dioxide films, 16: 21107
thermal conductivity, modification of three-phonon processes by isotopic scattering, 16: 21196
SEPARATION PROCESSES
development, 16: 20297(R) (ANL-6477(p.29-105))
development of adsorption methods, review, 16: 20316
for irradiated uranium fuels, chlorination method, 16: 20552
mechanism of foam, 16: 20537(R) (ORNL-TM-177)
research progress at Argonne National Lab., October to December 1961, 16: 20296(R) (ANL-6477)
SERUMS
contents of bromine, iron, and zinc in human, 16: 20098
effects of cancer radiotherapy on beta-glucuronidase activity, 16: 20258
effects of whole-body irradiation on protein levels in rats, 16: 20287
iodine content in human, protein-bound, 16: 20331
SHEEP
cesium-137 dosimetry, use of whole-body dose as indicator of gonad dose, 16: 20105
iodine-131 content of thyroids, Egypt, 1956 to 1957, 16: 20125
SHIELDED CONTAINERS
density measurements on wood for, interpretation, 16: 20861 (AHSB(S)R-36)
design for shipping and loading cobalt-60 sources, 16: 20586(P)
SHIELDING
development problems in cosmic radiation, 16: 20232
gamma attenuation in two-legged 11-in. rectangular concrete duct, 16: 21692 (NP-11657)
neutron cross section calculations, computer program for, 16: 21691 (DC-60-7-9)
requirements for radiation sources carried by space vehicles, 16: 20236
requirements for space vehicles, 16: 20235
requirements for space vehicles, 16: 20241
whole-body, effectiveness as protection of man against radiation injuries, 16: 20242
SHIELDING MATERIALS
development of light-weight boron, 16: 21690(R) (AD-267561L)
fabrication of flexible plastic film, 16: 20587(P)
properties of boron steel as, 16: 21034 (HW-SA-2583)
use of tungsten–uranium alloys as, 16: 21006(P)
SHIPPINGPORT ATOMIC POWER STATION, PENNA.
monitoring of environs, 1961, 16: 20906
SHIPPINGPORT PRESSURIZED WATER REACTOR
contamination levels during refueling, 16: 21806 (DLCS-3170101)
control rods, calibration, 16: 21797 (DLCS-1500103)
coolant purification system demineralizer recharging, 16: 21802 (DLCS-1800102)
coolant radionuclide distribution, core 1 seed 2, 16: 21824 (WAPD-PWR-TE-89)
cooling system demineralizer test, 16: 21804 (DLCS-2130102)
cooling system, governor valve opening test, 16: 21801 (DLCS-1740405)
fuel elements, location of failed, 16: 21823 (WAPD-PWR-TE-70)
heat exchanger, radiation levels in 1-B after shutdown, 16: 21803 (DLCS-1840402)
instrumentation calibration for coolant flow, 16: 21807 (DLCS-3370103(Rev.))
operation, 16: 21821(R) (TID-15502)
plant container integrity test, 16: 21809 (DLCS-3570105)
reactivity coefficients at 5532.3 EFPH, 16: 21798 (DLCS-1510108)
reactivity coefficients at OEFPH, core 1 seed 2, 16: 21799 (DLCS-1510109)
reactivity coefficients at power, core 1 seed 2, 16: 21800 (DLCS-1510205)
shutdown, effects of rapid, 16: 21808 (DLCS-3440103)
waste disposal, area monitoring, 16: 21860 (DLCS-1690203)
waste disposal operation during cooldown for refueling, 16: 21805 (DLCS-2390301)
SHOCK TUBES
use in testing overpressure effects on small animals, 16: 20864(R) (DASA-1242)
SHOCK WAVES
fronts in two-dimensional unsteady hydrodynamic flow, 16: 21210
interactions with bubbles, configurations from, 16: 20608

propagation from high-altitude explosions, 16: 20838
propagation in atmosphere, model for, 16: 20837
propagation in hydrogen, equilibrium attainment after, 16: 21666 (RISÖ-35)
properties from high-altitude explosions, 16: 20839
properties of magnetogasdynamic, in gases of variable conductivity, 16: 21178
structure, 16: 21662 (AFSWC-TDR-62-42)
structure in magnetohydrodynamics, 16: 21206

SILANES
preparation of silicate polymers, 16: 20350(R) (AGC-0423-01-3)
properties, improvement of physical by addition of vinyl groups, 16: 20350(R) (AGC-0423-01-3)
radiolysis, effects of acetylene, carbon dioxide, and water on hydrogen yield, 16: 20478
spectra of methyl, infrared, 16: 20428
viscosity, effects of crosslinking agents, 16: 20350(R) (AGC-0423-01-3)

SILANES (LABELED)
spectra of methyl trideutero-, infrared, 16: 20428

SILICON
analysis for deposited boron films, activation, 16: 20346
determination in rare earth oxides, spectrographic method for, 16: 20327
surface texture, determination of pole figures by reflection method, 16: 21017 (AE-68)

SILICON CARBIDES
radiation effects on junctions, 16: 20751

SILICON FLUORIDES
heat of formation, 16: 20299(R) (ANL-6477(p.155-67))

SILICON ISOTOPES Si-28
deuteron reactions (d,p) at 15 Mev, angular dependence of proton polarization in, 16: 21597
neutron reactions (n,α) at 13.5 to 14.7 Mev, cross-section oscillations in, 16: 21413
proton inelastic scattering at low energies, reaction mechanisms for, 16: 21393

SILICON ISOTOPES Si-30
energy levels excited by (α,p) reactions on aluminum-27, 16: 21417

SILICON JUNCTIONS
radiation effects of protons at 20.5 to 740 Mev, 16: 21093 (NP-11655)

SILICON OXIDES
heat of formation, 16: 20299(R) (ANL-6477(p.155-67))

SILICON–ZIRCONIUM SYSTEMS
preparation, 16: 20980(T,R) (EURAEC-26)

SILICONE POLYMERS
radioinduced crosslinking, protective effects of sulfur against, 16: 20507

SILTS
uranium content in Japanese sediments, 16: 20844

SILVER
corrosion by acids and chloride salts in chemical plants, 16: 20983
determination as trace in standard rocks G-1 and W-1, spectrographic, 16: 20831
determination in rare earth oxides, spectrographic method for, 16: 20327

SILVER GLASS
radioinduced coloration in phosphate, gamma, 16: 21099

SILVER ISOTOPES
content in iron meteorites, 16: 20829

SILVER ISOTOPES Ag-107
alpha reactions (α,n), indium-110 production from, 16: 21381
neutron reactions (n,2n), excitation functions for, 16: 21352 (NP-11667)
photon scattering at 4 to 24 Mev, cross sections for inelastic, 16: 21641

SILVER ISOTOPES Ag-109
alpha reactions (α,3n), indium-110 production from, 16: 21381

SILVER ISOTOPES Ag-110
decay of metastable, beta and gamma spectra from, 16: 21380
decay schemes, 16: 21380

SILVER OXIDES
radiation effects on films, on glass, 16: 21108

SKELETON
strontium saturation in mammalian, 16: 20108

SKIN
decontamination of thallium-204, effectiveness of solutions, 16: 20895
radiation dose from radiologic examinations for congenital heart disease, 16: 20890
radiation effects on wheal resorption time, 16: 20145
radiation effects on chemically induced eczema, 16: 20163
radiation effects on liquid diffusion in animal, during hibernation, 16: 20213
radiation effects, dependence on dose fractionation and time, 16: 20224
radioinduced ulcers, pathogenesis of, 16: 20132(T) (JPRS-13644)
radiotherapy of cutaneous epitheliomas, 16: 20092

SKIN GRAFTING
radiation effects on take in rabbits, 16: 20276
radiation effects on take in mice, 16: 20267

SKIN LESIONS
radioinduced, clinical morphology of surgical treatment, 16: 20278
radioinduced, therapeutic effectiveness of ointments containing steroids and antibiotics, 16: 20155

SLAGS
radioactivity measurements on building block, 16: 20871 (PAN-269-A)

SODIUM
determination in chicken by neutron activation, 16: 20337
determination in rare earth oxides, spectrographic method for, 16: 20327
determination in uranium compounds, spectroscopic, 16: 20525(R) (MCW-1472)
hyperfine structure, 16: 21129(R) (NP-11640)
ion exchange equilibria in system with cesium, 16: 20457
ion exchange equilibria cesium rate of movement in chromatographic, 16: 20458
metabolism by erythrocytes in patients with cardiac insufficiency, 16: 20101
separation from cerium by ion exchange on chernozem, 16: 20460

SODIUM (LIQUID)
circulation system, construction and operation, 16: 20576
corrosive effects on niobium–zirconium alloys at 2200°F, 16: 20042(R) (BNL-696)
density of cooling effects on reactivity in fast dilute reactors, 16: 21711 (AEEW-M-225)
monitoring for hydrogen, design of apparatus for continuous, 16: 20320 (NAA-SR-6986)

SODIUM BERYLLIUM PHOSPHATES
crystal structure, 16: 20442

SODIUM CHLORATES
radiolysis, effects of annealing, 16: 20506

SODIUM CHLORIDE CRYSTALS
electron-nuclear double resonance studies, 16: 21194
neutron reflectivity, 16: 20637 (JAERI-1030(Suppl.))
photoelectric effect in, at 20 to 500°C, 16: 21142(T) (CEA-tr-A-1087)

SODIUM CHLORIDES
corrosive effects on alloys and metals in chemical plants, 16: 20983
scintillation properties at low temperatures, 16: 20707

SODIUM CHLORIDES (LIQUID)
thermodynamics of titanium in, oxygen equilibrium potential diagram for, 16: 20426

SODIUM COMPOUNDS
boiling of aqueous solutions, hydrodynamic model for nucleate pool, 16: 20605

SODIUM FLUORIDES
scintillation properties at low temperatures, 16: 20707

SODIUM HYDRIDE–SODIUM HYDROXIDE SYSTEMS
phase studies and thermal stability, 16: 20388

SODIUM HYDRIDES
electron-nuclear double resonance studies, 16: 21194

SODIUM HYDROXIDES
reactions with uranyl salts, 16: 20368(T) (AEC-tr-4457(p.98-107))

SODIUM IODIDE CRYSTALS
scintillation efficiency of thallium-activated, to gamma rays and electrons, 16: 20713

SODIUM IODIDES
scintillation properties at low temperatures, 16: 20707

SODIUM IONS
diffusion in bentonite clay-water pastes, self-, 16: 20425
exchange on natural and synthetic exchangers, 16: 20356 (JÜL-32-RC)

SODIUM ISOTOPES Na-23

energy level schemes, intrinsic states in, 16: 21407
energy levels in, 16: 21498
fluorine isotope reactions (F^{p},F^{pn}) up to 43 Mev, 16: 21428
proton reactions (p,pn) at 20 to 155 Mev, excitation functions for, 16: 21484
SODIUM ISOTOPES Na-24
decay, beta-gamma circular-polarization correlation and isospin conservation in, 16: 21616
decay, polarization of electrons in beta, 16: 21614
disappearance from uterus during normal and toxemic pregnancy, 16: 20116
gamma spectra, 16: 20628 (ANL-6499)
SODIUM ISOTOPES Na-25
energy levels, 16: 21627
SODIUM REACTOR EXPERIMENT
fuel rods, effects of bowing on reactor stability, 16: 21722 (NAA-SR-6878)
SODIUM SILICATES
reactions with phenylmethyl dichlorosilane for preparation of silicate silane polymers, 16: 20350(R) (AGC-0423-01-3)
SODIUM SULFATES
properties as decontaminant for water cooled reactors, 16: 20984
SODIUM TITANIUM CHLORIDES
magnetic susceptibility, effects of temperature on, 16: 20423
SODIUM URANATES
formation in aqueous media, 16: 20385
SODIUM URANIUM(IV) FLUORIDES
production from uranyl nitrate by dry method, pilot plant for, 16: 20530
SOILS
adsorptive properties for cesium at Saclay, 16: 20826
composition, effects on uptake of fission products by plants, 16: 20885
composition, effects on uptake of fission products by plants, 16: 20886
radioactive solution placement in soils, development of probe for, 16: 20850
sorption of radiocerium by chernozem, 16: 20460
SOLAR BATTERIES
radiation effects on silicon, 16: 21092(R) (GACD-3001)
radiation effects of protons at 20.5 to 740 Mev on silicon, 16: 21093 (NP-11655)
studies by Explorer XII, data summary, 16: 20851
SOLAR FLARES
ionospheric effects, 16: 21233
Lyman alpha and x-ray emission by, 16: 21232
measurements from Explorer VI and Pioneer V with proportional counter telescope, 16: 20626 (AD-269307)
particle flux and radiation dose rate from, 16: 20241
proton emission and energies, 16: 20239
radiation hazards from, during space flight, 16: 20245
x-ray burst from event on Sept. 28, 1961, 16: 21238 (NP-11658)
SOLAR RADIATION
energy, 16: 20231
spectra of electromagnetic, 16: 20232
SOLIDS
book: *Solid State Physics. XIII.*, 16: 21221
diffraction studies, 16: 21010(R) (AD-264878)
electronic properties, analysis by cyclotron-resonance methods, 16: 21222
heat flow in melting, method for calculation, 16: 20613
radioinduced coloration in, gamma, 16: 21099
SOLVENT EXTRACTION PROCESSES
development of packed column, 16: 20305(R) (UCRL-10023)
SOUND
scattering by surfaces of arbitrary shape, 16: 21137 (UCRL-6779)
SPACE
biological and medical aspects of energies, 16: 20230
environmental effects on liquid propellants and their storage systems, bibliography, 16: 21845 (AD-266034)
geomagnetic fields, 16: 20234
magnetic field origin in, 16: 21234
particulate contents, 16: 20233
SPACE FLIGHT
magnetic field effects, 16: 20234
psychological aspects of meteorite encounter, 16: 20233
radiation hazards for man, 16: 20242
radiation hazards in, electromagnetic, 16: 20244
radiation hazards, 16: 20245
radiation hazards from particles heavier than carbon, 16: 20246
radiation tolerance criteria for man in, 16: 20882
SPACE VEHICLES
energy conversion and balance in manned, 16: 20237
nuclear power plants for, development, 16: 20236
power and propulsion systems, review of Kiwi, Rover, and SNAP, 16: 21857
power supplies, performance of magnetohydrodynamic, 16: 21151
power systems, effects of weightlessness on, 16: 21852
propulsion by arcjets, feasibility, 16: 21854
propulsion by electrostatic generators, feasibility, 16: 21855
propulsion, review of developments in electric, 16: 21853
radiation dosage determinations in, calculation principles, 16: 21844 (AD-263476)
radiation environment of interior, 16: 20235
shielding against electromagnetic radiation, 16: 20244
shielding requirements, 16: 20241
SPARK DETECTORS
array design, 16: 20680
design and performance, 16: 20729
design and performance, 16: 20730
design and performance of cylindrical, 16: 20731
design and performance for rare modes of meson decay, 16: 20732
design and performance of radiation-image type, 16: 20733
development status, 16: 20641 (NP-11616)
discharge conditions along path of ionizing particle in, evaluation, 16: 20638 (JINR-D-870)
electrical characteristics of sphere-plane type, 16: 20738
particle track location accuracy in triggered, 16: 20684
SPECIFIC HEAT
anharmonic contributions to, 16: 21185
SPECTRA
book: *Solid State Physics. XIII.*, 16: 21221
SPECTRAL SHIFT CONTROL REACTOR
hazards evaluation, 16: 20863 (BAW-1215(& Suppl.1))
SPECTROMETERS
design for recording spectrum variations with time, 16: 20578(P)
design for studies of plasma discharges, 16: 21684
design of multi-dimensional selector with magnetic memory, 16: 20774
SPECTROSCOPY
design concept of spectrochemical source, 16: 20304 (CRL-73)
use of angular correlations measurements in nuclear, 16: 21351 (NP-11651)
SPINAL CORD
strontium uptake by lesions, in man, 16: 20081
SPLEEN
effects of lethal irradiation in rats, protective effects of desoxyribonucleic acid, 16: 20283
protective effects against radiation in mice, 16: 20160
protective effects of cells against radiation in mice, 16: 20263
radiation effects on antibody formation by cells in mice, 16: 20274
radiation effects, relation to bone marrow radiation damage, 16: 20262
SPUTTERING
by deuterons in the Rutherford collision region, 16: 21183
research progress, review, 16: 21115 (AD-267458(Pt.I))
yields at low bombarding energies, 16: 21116 (AD-267458(Pt.V))
STAINLESS STEEL
coating with thorium by electrolysis, 16: 20963
contamination by radionuclides in water-cooled reactors, 16: 21717 (DP-582)
corrosion by acids and chloride salts in chemical plants, 16: 20983
corrosion by decontaminating solutions, 16: 20984
radiation damage in 410, 16: 21086 (AECL-1484)
sintering, 16: 21078
sorptive properties for radioisotopes in boiling-water reactor, 16: 20303(R) (ANL-6477(p.224-30))
sputtering with electric arc, characteristic stages, 16: 20968
strength, effects of severe stress and thermal histories, 16: 21023

(ASD-TR-61-194)
stress-corrosion cracking, abstracts of reorts on, 16: 20978 (DP-683)
thermal stress, 16: 20811(P)
STARS
formation in elliptical galaxies as radio sources, 16: 21235
STATISTICS
book: *Fundamental Problems in Statistical Mechanics*, 16: 20949
book: *Quantum Theory of Many-Particle Systems*, 16: 21223
STEAM POWER PLANTS
design and performance of 15,000 hp compact, 16: 20558 (AD-269397)
STEAM–WATER SYSTEMS
flow through aperture, 16: 20615
STEARIC ACID
etching effects on lithium fluoride crystals, adsorption-locking and Rebinder effect in, 16: 20437
STEARIC ACID, METHYL ESTER
protective effects against radiation sickness in gonads of male mice, 16: 20285
STEEL
analysis for arsenic, cobalt, and manganese, neutron activation, 16: 20330
corrosion by acids and chloride salts in chemical plants, 16: 20983
corrosion in carbon dioxide at 0 to 15 atm and 450 to 500°C, 16: 20986
hardness and structure of quenched, 16: 21069
production by vacuum metallurgy, 16: 20967
radiation effects on brittle-ductile transition in En2, neutron, 16: 21068
radiation effects on pressure vessel, 16: 21090(R) (EURAEC-140)
radiation effects on atmospheric corrosion, 16: 21098
radiation effects on mechanical properties of mild, 16: 21100
thermal stress, 16: 20811(P)
STEROIDS
protective effects of dexamethasone against radioinduced leukopenia, 16: 20269
therapeutic effects of ointments, in radioinduced skin lesions, 16: 20155
STEROIDS, 17-KETO-
radiation effects on urinary excretion, whole-body exposure, 16: 20209
STRESS ANALYSIS
determination of materials behavior from true stress-strain relations, 16: 20806 (NAA-SR-6376)
determination of plastic pressure-deformation in pressure vessel of anisotropic material, theory for, 16: 21735
determination of strain hardening in compound cylinders, theory for, 16: 20965
techniques for, photostress and photoelastic, 16: 21026 (DC-59-6-224 and Add.)
use of piezoelectric crystals for, 16: 20808 (PNE-105P)
STRESS CORROSION
abstracts of reports on, 16: 20978 (DP-683)
STRONTIUM
binding by serum proteins, 16: 20111
decorporation from rat skeleton, effects of strontium disodium chelate of 2,2'-bis[di(carboxymethyl)amino]diethylether, 16: 20060
determination as trace in standard rocks G-1 and W-1, spectrographic, 16: 20831
dietary availability from milk, tracer study, 16: 20899
metabolism in bone, tracer study, 16: 20064
metabolism in bones in rats, 16: 20118
saturation of mammalian skeleton with, 16: 20108
separation from rubidium by isotope dilution, 16: 20332
sorption on clay, effect of pH, 16: 20075
uptake by spinal cord lesions in man, 16: 20081
STRONTIUM GERMANATES
crystal structure and symmetry, as model for α wollastonite, 16: 20441
STRONTIUM IONS
diffusion in bentonite clay-water pastes, self-, 16: 20425
exchange on natural and synthetic exchangers, 16: 20356 (JÜL-32-RC)
STRONTIUM ISOTOPES Sr-89
deposition in hen's eggs, 16: 20109
energy levels, determination of neutron, 16: 21495
separation from waste solutions by flocculation, 16: 21862
STRONTIUM ISOTOPES Sr-90
absorption of ingested or inhaled, effects of treatment with barium sulfate, 16: 20077
content in hay in Germany, 1953 to 1961, 16: 20128
content in human placenta, comparison with bone in newborn, 16: 20107
determination in environmental materials, radiochemical procedures, 16: 20870 (NYO-9934(Vol.III)(Ext.))
global integrals from fall-out, 1958 to 1960, 16: 20905
monitoring environmental, Mol, 1960, 16: 20813(R) (A/AC.82/G/L.721)
monitoring environmental, Mol, 1960, 16: 20812(R) (A/AC.82/G/L.711)
uptake by goldfish gills, 16: 20106
STRONTIUM NITRATES
decontamination, design of radiochemical waste evaporator system for, 16: 21861
STRONTIUM OXIDES
radiation effects on films, on glass, 16: 21108
STRONTIUM TITANATES
acoustic properties of crystalline at 4 to ~300°K and 10 to 150 mc/sec, 16: 21032 (D1-82-0163)
STYRENE POLYMERS
fluorescence spectra, relations with molecular weight and styrene monomer content, 16: 21125(R) (ANL-6517)
ion exchange capacity and structural rigidity, effects on separatory efficiency for rare earths, 16: 20371(T) (AEC-tr-4457(p.187-9))
radiation effects on polymerization processes and rates, 16: 20483
SUBMARINE POWER PLANTS
design and performance of 15,000 hp compact, 16: 20558 (AD-269397)
force and torque variations of 36-cylinder double-acting steamotor for, 16: 20556 (AD-269392)
SULFAMIC ACID
properties as decontaminant for water cooled reactors, 16: 20984
SULFATES
radiation effects, measurement of amount and composition of radiation products, 16: 20466 (AERE-R-3409)
SULFINATES
phenyl benzenethiol-, reactions with 1-chloro-2,4-dinitrobenzene and synthesis of sulfur-35 labeled from thiophenol, 16: 20499
SULFONATES
phenyl benzenethiol-, synthesis of sulfur-35 labeled from thiophenol, 16: 20499
SULFUR
crystal structure of orthorhombic, 16: 20380
determination in chicken by neutron activation, 16: 20337
meson (μ^-) reactions (μ^-, $n\nu$) with polarized muons, angular distributions, 16: 21416
protective effects of colloidal suspensions against radioinduced cross-linking of polymers, 16: 20507
SULFUR ISOTOPES S-32
gamma transitions in, 16: 21497
proton inelastic scattering at low energies, reaction mechanism for, 16: 21393
SULFUR ISOTOPES S-34
energy levels excited by (α,p) reactions on phosphorus-31, 16: 21417
SULFUR ISOTOPES S-35
radiochemistry, 16: 20305(R) (UCRL-10023)
SULFURIC ACID
proton paramagnetic resonance in aqueous solutions, 16: 20464
radiolysis of solution containing nitrous oxide, G values for, 16: 20514
SULFURIC ACID–URANYL SULFATE SYSTEMS
density at 20 to 50°C, 16: 20435
SUN
radiations from, 16: 20231
SUPERCONDUCTIVITY
theory, functional derivative techniques in, 16: 21181
SUPERHEATERS (NUCLEAR)
conference on nuclear superheat projects, 16: 21817 (TID-7630)
design without steam pumping, 16: 21835(P)
development, 16: 21812(R) (GNEC-230)
SUPERSONIC FLOW
plasma jet interactions with magnetic field, 16: 20619
SURFACE WATERS
analysis in uranium mining and milling area of Colorado Plateau, 16: 20815 (NYO-7831)
flow measurements, dispersion and persistence of radioisotope in

tracer techniques for, 16: 20836
radioactivity, in Prague, 16: 20878(T) (AECL-1498)
SURFACES
area measurement by continuous flow method, 16: 20525(R) (MCW-1472)
SWIMMING POOL REACTORS
fuel element burnup analysis of Soria, 16: 21734
poisoning of Pegase and Siloé, effects on shutdown behavior, 16: 21738
SWITCHES
design of automatic electronic, 16: 20773
SYNCHROTRONS
particle production in CERN proton, low-energy, 16: 21645 (CERN-62-19)
SYSTEMS FOR NUCLEAR AUXILIARY POWER
development, review, 16: 21857
SYSTEMS FOR NUCLEAR AUXILIARY POWER (SNAP-7)
development, 16: 21127(R) (MND-P-2483-5)

T

TANTALUM
alpha and carbon-12 reactions, gamma distributions from, 16: 21457
brittle-ductile transition, 16: 21068
content in standard rocks G-1 and W-1, 16: 20830
corrosion by acids and chloride salts in chemical plants, 16: 20983
determination in granite G-1, activation and x-ray fluorescence, 16: 20832
emission behavior in plasma diodes, 16: 21138 (UCRL-6809)
mechanical properties of fused and sintered, 16: 21079
oxidation at 300 to 550°C, 16: 21021 (ARL-240)
properties for use in vacuum insulation to 4000°F, 16: 20590 (ASD-TDR-62-88)
proton reactions at 5.7 Bev, 16: 21424
TANTALUM BROMIDES
heat of formation, 16: 20450
TANTALUM ISOTOPES
nuclear gyromagnetic ratios and quadrupole moments, 16: 21446
TANTALUM ISOTOPES Ta-178
decay scheme, 16: 21422
decay schemes of two isomers, 16: 21423
TANTALUM ISOTOPES Ta-181
energy level g-factor at 482 kev, 16: 21414
energy levels and E3 and E4 gamma spectra, 16: 21450
energy levels, lifetimes, 16: 21440
gamma cascade at 133 to 482 kev, attenuation of anisotropy in liquids, 16: 21350 (NP-11602)
gamma E1 spectra and half lives, 16: 21458
gamma scattering, properties of giant resonance, 16: 21456
gamma spectra, E2 emission parameters, 16: 21444
internal conversion, nuclear structure effects, 16: 21449
TANTALUM SILICIDES
heats of formation, 16: 20394
TANTALUM–TUNGSTEN ALLOYS
fabrication by extrusion in Tee shapes, 16: 20992(R) (ASD-TR-7-783(III))
machining studies, 16: 20990(R) (ASD-TR-7-532a(VI))
TANTALUM–ZIRCONIUM ALLOYS
phase studies, 16: 21036(R) (NMI-9235)
TECHNETIUM ISOTOPES Tc-99
separation of isomer from neutron-irradiated uranium by fractionated sorption on aluminum oxide, 16: 20544
TELLURIDES
thermoelectric properties, 16: 21012(R) (AD-265328)
TELLURIUM
alpha and carbon-12 reactions, gamma distributions from, 16: 21457
analysis for iodine-131, radiometric, 16: 20489
TELLURIUM ISOTOPES Te-123
decay and half life, 16: 21405
TELLURIUM ISOTOPES Te-132
separation from neutron-irradiated uranium by fractionated sorption on aluminum oxide, 16: 20544
TELLURIUM OXIDES
radiation effects on films, on glass, 16: 21108
TEMPERATURE
generation of high, apparatus, 16: 20588(P)
TEMPERATURE CONTROL
in irradiations with cobalt-60 hollow-cylinder source, development of system for, 16: 20572
TERBIUM ISOTOPES
nuclear gyromagnetic ratios and quadrupole moments, 16: 21446
TERBIUM ISOTOPES Tb-149
alpha decay, 16: 20305(R) (UCRL-10023)
properties of heavy-ion-induced, 16: 20305(R) (UCRL-10023)
TERBIUM ISOTOPES Tb-156
energy levels of odd-odd, 16: 20305(R) (UCRL-10023)
TERBIUM ISOTOPES Tb-159
energy levels, lifetimes, 16: 21440
gamma spectra, E2 emission parameters, 16: 21444
TERPHENYLS
electron-induced triplet excitation, 16: 20467 (ASD-TDR-62-32(Pt.II))
use as quencher in organic systems, 16: 20470(R) (NP-11604)
TESTOSTERONE
protective effects in gamma-irradiated male and female rats, 16: 20183
THALLIUM ISOTOPES Tl-201
internal conversion, nuclear structure effects, 16: 21449
THALLIUM ISOTOPES Tl-203
energy level at 279 kev, lifetime, 16: 21434
energy levels, lifetimes, 16: 21440
internal conversion, nuclear structure effects, 16: 21449
nuclear magnetic moments of excited states, 16: 21448
THALLIUM ISOTOPES Tl-207
gamma decay, plane polarization, 16: 21369
THALLIUM ISOTOPES Tl-208
decay scheme, 16: 21392
THERMAL CONDUCTIVITY
of fluids, correlation function calculation, 16: 21198
of solids, modification of three-phonon processes by isotopic scattering, 16: 21196
THERMAL INSULATION
materials development for vacuum, 16: 20590 (ASD-TDR-62-88)
THERMAL NEUTRON CROSS SECTIONS
measurement, design of instrument for, 16: 21333 (CRRP-1078)
THERMAL NEUTRONS
capture in hafnium, 16: 21395
detection and measurement using thermoluminescence of lithium fluoride, 16: 21171
detection and measurement, calibration of converted Pee Wee survey instrument for, 16: 20640 (LAMS-2697)
detection and measurement using plastic scintillators, 16: 20717
detection and measurement, gamma-insensitive scintillation detector for, 16: 20718
reactions (n,α) with beryllium-7, alpha properties from, 16: 21401
reflection by beryllium, lithium fluoride, and sodium chloride single crystals, 16: 20637 (JAERI-1030(Suppl.))
scattering by moderators, data analysis scheme, 16: 21332 (AERE-R-4041)
scattering by water, calculation of angular distribution, 16: 21343
scattering, development of instrument for velocity distribution measurements in, 16: 21333 (CRRP-1078)
THERMAL RADIATION SHIELDING
effectiveness of window glass in, 16: 20860 (APSWP-792)
THERMAL REACTORS
design of Argonne Thermal Source Reactor, 16: 21714 (ANL-6440)
kinetic behavior, comparison with fast reactors, 16: 21743
THERMAL STRESSES
evaluation in flat disks of high-temperature material, apparatus for, 16: 21030 (DC-60-3-110)
in reactor pressure vessels in vicinity of coolant inlet, 16: 21729
measurement, apparatus, 16: 20811(P)
THERMIONIC CELLS
design and development for solar power systems, survey, 16: 21849 (WADD-TR-60-698(Pt.I))
properties of iridium, rhenium, tantalum, and tungsten for use as cathodes in, 16: 21138 (UCRL-6809)
THERMOCOUPLES
fabrication from Chromel-A and 875 alloy, 16: 20633 (DC-59-10-202)

THERMOELECTRIC CELLS
design, 16: 21140(T) (AEC-tr-5048)
development, 16: 21110(R) (AD-251485)
development, 16: 21112(R) (AD-266009)
development, 16: 20301(R) (ANL-6477(p.204-16))
development of encapsulated, 16: 21109(R) (AD-237966)
development of encapsulated, 16: 21131(R) (NP-11647)
materials, development of high-temperature refractory metal combinations, 16: 21111(R) (AD-265106)
use in direct-conversion reactors, 16: 21791 (AD-267442)
THERMOELECTRIC MATERIALS
annealing effects on chalcopyrite, 16: 21007 (AD-230373)
development, 16: 21012(R) (AD-265328)
THERMOLUMINESCENCE
bibliography, 16: 21133 (TID-3911)
THERMOMETERS
calibration and operation of gas-filled, 16: 20646 (TRG-Report-261)
THERMONUCLEAR EXPLOSIONS
detection and identification of underground and high-altitude, 16: 20854
detection and identification of underground and high-altitude, 16: 20855
summary information, Jan. 1962, 16: 20905
summary information, March 1962, 16: 20906
summary information, April 1962, 16: 20907
test ban proposal status, July 1961, 16: 20854
test ban proposal status, July 1961, 16: 20855
THERMONUCLEAR REACTORS
discharge spectra, spectroscopic studies, 16: 21684
THICKNESS GAGES
development for measuring weight of ammunition primer compositions in assembled primer cups, 16: 20917
THIOPHENE
exchange kinetics of hydrogen isotopes in, 16: 20383
THIOSULFATES
radiation effects, measurement of amount and composition of radiation products, 16: 20466 (AERE-R-3409)
THORIUM
determination in hydrochloric acid–methanolic media using azo dyes, spectrophotometric, 16: 20348
determination in monazites polarographic, 16: 20325(T) (NP-tr-895)
determination in ores, development of rapid method for, 16: 20328
determination using rutin, spectrophotometric, 16: 20427
dissolution by the Thorex process, 16: 20534(R) (IDO-14574)
distribution and excretion following inhalation, 16: 20476 (UR-605)
properties and uses, 16: 20852
proton reactions (p,αxn) at 155 Mev, mechanism, 16: 21374
separation from acid aqueous solutions, adsorbent for, 16: 20311(P)
separation from elements with atomic numbers 89 to 95 by paper chromatography, 16: 20340
separation from monazites, 16: 20343
THORIUM ALLOYS
properties and uses, 16: 20852
THORIUM CARBIDES
crystal structure and hydrolysis, 16: 21060
reactions with water, 16: 20537(R) (ORNL-TM-177)
THORIUM CARBONATES
calcination and sintering of oxycarbonate, 16: 20529
THORIUM CHLORIDES
calcination and sintering, 16: 20529
THORIUM COMPLEXES
with 3-cyanopentane-2,4-dione, stretching frequency of cyano group in, 16: 20421
THORIUM FILMS
deposition on nickel, nickel-plated aluminum, and stainless steel electrolytic, 16: 20963
THORIUM IONS
effects on sugar sorption by rat intestine, 16: 20115
mobility in aqueous nitrate solutions, 16: 20459
sorption on paper impregnated with ion-exchange resins, 16: 20341
THORIUM ISOTOPES Th-226
energy level at 72 kev, lifetime, 16: 21434
THORIUM ISOTOPES Th-232
performance as fertile elements in boiling reactors, 16: 21736
THORIUM MINERALS
book: *Thorium Mineral Resources, Chemistry and Technology*, 16: 20852
THORIUM NITRATES
calcination and sintering, 16: 20529
electric conductivity of aqueous solutions, 16: 20459
hydrolysis of aqueous solutions, acid extraction by amine, 16: 20434
reactions with sodium arsenite solutions, effects of pH on, 16: 20384
THORIUM OXALATES
calcination and sintering, 16: 20529
THORIUM OXIDE POWDERS
calcination and sintering, 16: 20529
preparation of dense by a sol-gel process, 16: 20960 (ORNL-3225)
THORIUM OXIDE SLURRIES
recombination of gases in, catalyst, 16: 20310(P)
THORIUM OXIDE–URANIUM OXIDE SLURRIES
radiation effects of thermal neutrons at 250 to 300°C, 16: 21095 (ORNL-3274)
recombination of gases in, catalyst, 16: 20310(P)
THORIUM OXIDE–URANIUM OXIDE SYSTEMS
density differences from calcination of various thorium oxides, 16: 20529
fabrication of dense, 16: 21819 (TID-15373)
fuel characteristics in boiling reactors, 16: 21736
preparation of dense by a sol-gel process, 16: 20960 (ORNL-3225)
THORIUM OXIDES
properties for use in vacuum insulation to 4000°F, 16: 20590 (ASD-TDR-62-88)
THORIUM(IV) OXIDES
diffusion of inert gases in, 16: 21048(T,R) (EURAEC-18)
diffusion of xenon in, 16: 21049(T,R) (EURAEC-121)
reduction by aluminum, equilibrium in, 16: 20424
THORIUM SILICIDES
heats of formation, 16: 20394
THORIUM SULFIDES
synthesis at high pressure, 16: 21112(R) (AD-266009)
THORIUM–URANIUM ALLOYS
production, 16: 20532(P)
THULIUM ISOTOPES
nuclear gyromagnetic ratios and quadrupole moments, 16: 21446
THULIUM ISOTOPES Tm-169
gamma E1 spectra and half lives, 16: 21458
gamma spectra, E2 emission parameters, 16: 21444
THYMIDINE
incorporation of labeled in cells, radiation effects from, 16: 20222
nucleotide pool in experiments with tritiated, problem on size, 16: 20104
THYMINE
effects on sensitivity of *Streptococcus faecalis* to ultraviolet radiation, 16: 20151
THYMUS
lymphoma induced in mice, by urethan, 16: 20074
THYROID GLAND
iodine-131 absorption following radiotherapy of cervical carcinoma, 16: 20102
iodine-131 accumulation in alimentary and cardiovascular diseases, 16: 20100
iodine-131 content of cattle and sheep in Egypt, 1956 to 1957, 16: 20125
iodine-131 effective half life in, 16: 20085
iodine-131 effects on children, possible harmful, 16: 20891
THYROXINE
metabolic effects on strontium and calcium in bone, 16: 20064
TIMING CIRCUITS
design of 20 MHz transistorized, for a time-of-flight selector, 16: 20766
TIN
content in standard rocks G-1 and W-1, 16: 20830
determination as trace in standard rocks G-1 and W-1, spectrographic, 16: 20831
determination in rare earth oxides, spectrographic method for, 16: 20327
meson (μ) scattering at 298 to 773 Mev/c, 16: 21248
preparation and physical and superconducting properties of gray, 16: 21222
properties of gray semiconducting, 16: 21010(R) (AD-264878)

TIN (LIQUID)
density, 16: 21041(R) (TID-15663)
TIN CHLORIDES
radioinduced oxidation of divalent, in hydrochloric acid solutions, 16: 20479
TIN ISOTOPES Sn-115
production from indium-115, 16: 21405
TIN ISOTOPES Sn-116
alpha scattering, characterization of 1.28 and 2.23 Mev levels from, 16: 21499
TIN ISOTOPES Sn-119
nuclear properties, study by Mössbauer effect, 16: 21447
TIN OXIDES
radiation effects on electric conductivity of antimony-activated films, 16: 21107
TIN–URANIUM–ZIRCONIUM ALLOYS
dissolution by hydrofluoric acid, kinetics, 16: 20535(R) (IDO-14583)
TIN–ZIRCONIUM ALLOYS
absorption properties of Zircaloy-2 for hydrogen up to 400°C, effects of stresses, 16: 20985
corrosion by water at 300°C, effects of fluoride ions, 16: 20977 (CRGN-1082)
corrosion of Zircaloy-2 by steam and water up to 400°C, effects of stresses, 16: 20985
corrosion rates in steam or water at 360, 400, and 480°C, 16: 20982(T,R) (EURAEC-85)
creep of Zircaloy-2, activation energies for stresses between 20,000 and 30,000 psi and at 50 to 500°C, 16: 21033 (HW-70151)
diffusion of hydrogen in alpha-delta, mechanism, 16: 21075
fatigue strength of Zircaloy-2, studies by alternating torsion at room temperature, 16: 21065
hydridation, 16: 21810(R) (DP-725)
radiation damage, 16: 21086 (AECL-1484)
tensile properties, 16: 20981(T,R) (EURAEC-27)
TISSUE CULTURES
mitosis in, effects of irradiated media on, 16: 20204
radiation effects on poliovirus yield in kidney, from rhesus monkey, 16: 20201
TISSUES
analysis of tracer distribution in, development of autoradiographic apposition method for, 16: 20338
radiation effects on sorptive properties, 16: 20157(T)
radiation effects, high-energy cosmic, 16: 20239
radiation effects, secondary cosmic, 16: 20240
radioinduced anomalies in interkinetic nuclei, 16: 20215
TITANIUM
alloying effects on strain-aging in niobium alloys, 16: 21063
corrosion by acids and chloride salts, 16: 20983
determination as trace in standard rocks G-1 and W-1, spectrographic, 16: 20831
determination in rare earth oxides, spectrographic method for, 16: 20327
determination, organic reagents for, 16: 20349
metallurgical effects on explosive forming of molybdenum, 16: 20994(R) (NP-11621)
purification by electrolysis, 16: 20969(P)
thermodynamics in chloride systems (liquid), oxygen equilibrium potential diagram for, 16: 20426
TITANIUM ALLOYS
corrosion by acids and chloride salts, 16: 20983
TITANIUM BROMIDES
magnetic properties at 80 to 300°K, 16: 20423
TITANIUM CHLORIDES
magnetic properties at 80 to 300°K, 16: 20423
TITANIUM COMPLEXES
magnetic susceptibility of hexaureatitanium(III) perchlorate, effects of temperature on, 16: 20423
TITANIUM FLUORIDES
heat of formation, 16: 20299(R) (ANL-6477(p.155-67))
magnetic properties at 80 to 300°K, 16: 20423
TITANIUM IODIDES
magnetic properties at 80 to 300°K, 16: 20423
TITANIUM ISOTOPES Ti-48
proton inelastic scattering at low energies, reaction mechanisms for, 16: 21393
proton reactions (p,α) at 18 Mev, seniority wave function effects on angular distributions and cross sections, 16: 21578
TITANIUM OXIDE FILMS
radiation effects on, applied to glass, 16: 21108
TITANIUM OXIDES
catalytic effects on deuterium-hydrogen exchange, 16: 20433
TITANIUM SILICIDES
heats of formation, 16: 20394
TITANIUM–ZIRCONIUM ALLOYS
phase studies and tensile properties, 16: 21058
reactions with hydrogen, phase studies, 16: 21072
TOLUENE
solubility in sulfuric acid, effects of isotopic mass of hydrogen, 16: 20382
TRACER TECHNIQUES
source counting rate calculations for, 16: 20488
TRACER TECHNIQUES (BIOLOGY)
for localization of gastrointestinal hemorrhage, 16: 20058
for studying peripheral blood circulation in foot, 16: 20053
TRACER TECHNIQUES (CHEMISTRY)
use of hydroquinone–krypton-85 clathrate to determine oxidation-reduction states, 16: 20324(R) (TID-15661)
TRACER TECHNIQUES (ENGINEERING)
methods for process control, 16: 20912
use in mechanical engineering, survey, 16: 20916
TRACER TECHNIQUES (GEOLOGY)
methods for river flow measurements, dispersion and persistence of radioisotope in, 16: 20836
porosity analysis of dolomite aquifers, 16: 20840
TRACER TECHNIQUES (MEDICINE)
visualization of pancreas by isotope scanning, 16: 20114
TRACER TECHNIQUES (METALLURGY)
methods for analyses in beryllium extraction metallurgy, 16: 20950 (BM-RI-5980)
TRANSDUCERS
development for indicating very small displacements using radioisotopes, 16: 20913
TRANSPLUTONIC ELEMENTS
preparation, 16: 20305(R) (UCRL-10023)
TRAUMA
effects on recovery of muscle from radiation damage, 16: 20166
TREES
radiation effects on leaf color mutations, 16: 20207
TRICHINOSIS
radiation effects on *Trichinella spiralis*, 16: 20135
radiation effects on immunogenicity of *Trichinella spiralis*, 16: 20137
TRIPHENYLMETHYL
reactions, rearrangements of ion pair intermediates in, 16: 20399
TRITIUM
content in Ehole (Angola) meteorite, 16: 20842
content in iron and stone meteorites, 16: 20827
deuteron reactions (d,n), angular distribution of neutrons, 16: 21370
deuteron reactions (d,n), yield at 8 to 200 kev, 16: 21358 (SERL-TR-M-61)
dosage measurements with film dosimeters, 16: 20687
emission spectra in activated illuminants, method for measuring, 16: 21367
exchange with deuterium in thiophene, 16: 20383
incorporation in hydrocarbons, evaluation of catalysts for, 16: 20490
labeling organic compounds with, by hot synthesis, 16: 20473(T) (AEC-tr-5082)
proton reactions (p,n) threshold energy, 16: 21630
radiation effects on incorporation in brain and liver of mice, 16: 20221
radioautographs, resolving power, 16: 20508
reactions with helium-3 at 3.23 Mev, neutron production in, 16: 21573
TRITONS
beta emission, nuclear matrix element from, 16: 21384
detection and measurement, semiconductor detector systems for, 16: 20746
energy spectra from proton interactions with carbon and gold at 154 Mev,

16: 21488
matrix elements and wave functions for, 16: 21284
reactions (t,α) at 1 to 2 Mev, cross sections, 16: 21569
reactions (t,α) with lithium-7 at 1 to 2 Mev, cross sections, 16: 21570
reactions (t,d) with boron-10 and lithium-6 at 0.9 to 2.0 Mev, cross sections, 16: 21567
TUBERCULOSIS
resistance to, effects of metabolic activity and irradiation of vaccinated rabbits, 16: 20068
TUMORS
diagnosis of pigmentary neoplasms in eye using phosphorus-32, 16: 20073
effects of injected cells on irradiated mice, 16: 20268
localization of cobalt-57-labeled porphirin chelates, 16: 20072
mortality in Nagasaki bomb survivors, 16: 20250
radiation effects on metabolism of Yoshida ascites hepatoma cells, 16: 20194
radiation effects, dependence on dose fractionation and time, 16: 20224
radioinduced in ovaries of mice, effects of single gamma dose on frequency of occurrence, 16: 20168
radioinduced in rat mammary gland, effects of injected tumor fluid, 16: 20253
radioinduced regression of Murphy-Sturm lymphosarcoma in rats, 16: 20131 (UR-575)
radiotherapy of cerebral, frontal bone sarcoma induction by, 16: 20171
radiotherapy of multiple myeloma with yttrium-90, 16: 20070
therapy of lung, with radioactive gold (colloidal), 16: 20099
TUNGSTEN
brittle-ductile transition, 16: 21068
content in standard rocks G-1 and W-1, 16: 20830
diffusion of cesium on surface, 16: 21053
emission behavior in plasma diodes, 16: 21138 (UCRL-6809)
fabrication by explosive forming, 16: 20994(R) (NP-11621)
hardness, 16: 21080
hardness and tensile properties, 16: 20955(R) (NMI-2105)
machining studies, 16: 20990(R) (ASD-TR-7-532a(VI))
TUNGSTEN CRYSTALS
growth and orientation of needle-shaped, 16: 21083
TUNGSTEN ISOTOPES
nuclear gyromagnetic ratios and quadrupole moments, 16: 21446
TUNGSTEN ISOTOPES W-182
energy levels, lifetimes, 16: 21440
gamma spectra, EO transition probabilities, 16: 21445
gamma spectra, E2 emission parameters, 16: 21444
TUNGSTEN ISOTOPES W-184
gamma spectra, EO transition probabilities, 16: 21445
gamma spectra, E2 emission parameters, 16: 21444
TUNGSTEN ISOTOPES W-186
gamma spectra, E2 emission parameters, 16: 21444
TUNGSTEN ISOTOPES W-187
decay schemes, 16: 21383
TUNGSTEN OXIDES
thermodynamic properties at high temperatures for variable composition, 16: 21055
TUNGSTEN SILICIDES
heats of formation, 16: 20394
TUNGSTEN–URANIUM ALLOYS
use as radiation shielding materials, 16: 21006(P)
TURBOJET ENGINES
radiation effects on accessory systems of, 16: 21096 (XDC-60-2-116)

U

ULCERS
pathogenesis of radioinduced skin, 16: 20132(T) (JPRS-13644)
ULTRAVIOLET RADIATION
biological effects on blood platelets in mice, effects of x radiation, 16: 20290
effects on deoxyribonucleic acid crosslinking to protein, 16: 20198
effects on deoxyribonucleic acid strand separation and recombination, 16: 20193
effects on photosynthesis in algae, 16: 20238
effects on physical properties of ribonucleic acid, 16: 20150
effects on *Streptococcus faecalis*, effects of treatment with 5-azathymine, 16: 20151
genetic effects on *Chlamydomonas reinhardi*, mutations, 16: 20203
oxidation and reduction of iron in benins by exposure, 16: 20146
sensitivity of *Escherichia coli*, effects of treatment with 5-fluorouracil, 16: 20149
ULTRAVIOLET SPECTRA
table of multiplets for elements hydrogen to niobium (Z 1 to 41), 16: 20358 (NBS-C-488(Sect.4))
tables of multiplets for elements Z = 42 to 57 and 72 to 88, 16: 20357 (NBS-C-488(Sect.3))
UNDERGROUND EXPLOSIONS
core testing and grouting operations for Project Gnome, 16: 20046 (PNE-116F)
crater formation in desert alluvium in Project Stagecoach, 16: 20049 (SC-4596(RR))
detection and identification, 16: 20854
detection and identification, 16: 20855
ground motion measurements in Project Gnome, review, 16: 20872 (PNE-128F)
mine survey before and after Project Gnome, 16: 20048 (PNE-134F)
radiological safety on-site in Project Gnome, 16: 20873 (PNE-133F)
seismic amplitudes of chemical and nuclear, effects of depth, 16: 20823
URACIL, 5-FLUORO-
effect on ultraviolet sensitivity of *Escherichia coli*, 16: 20149
URAL MOUNTAINS (SOVIET UNION)
rare earth content of peridotite, 16: 20835
URANIUM
accumulation in plants, 16: 20090
book: *Thermal Studies of Uranium and Uranium-Bearing Minerals*, 16: 20853
burnup measurements, use of cesium tetraphenylborate extraction in, 16: 20317 (HW-72199)
chemical form in apatites, 16: 20825
content in Japanese sediments, 16: 20844
criticality limits for scrap, 16: 20867 (HW-70351(Rev.))
crystal structure of alpha, 16: 20380
crystal structure of gamma-extruded alpha, 16: 20525(R) (MCW-1472)
determination in copper ores, 16: 20847
determination in hydrochloric acid–methanolic media using azo dyes, spectrophotometric, 16: 20348
determination in ores, development of rapid method for, 16: 20328
forging of extruded tubular, 16: 20993 (NLCO-842)
gravimetric factors for compounds of, 16: 20319 (K-1476(Rev.1))
microstructure, effects of ion bombardment, 16: 20953 (HW-73476)
mining and milling area on Colorado Plateau, stream survey in, 16: 20815 (NYO-7831)
mining, health hazards, 16: 20893
mining in Australia, 16: 20044 (NP-11606)
neutron flux distribution, radial measurements in heavy water lattices, 16: 21810(R) (DP-725)
neutron spectra in natural, thermal-neutron-induced fast spectra, 16: 21338
preparation by electrolysis of oxides at 1150°C in fused fluorides, 16: 20527
production by halide reduction in organic solvent, 16: 20533(P)
production from ammonium and sodium uranous fluorides, pilot plants for, 16: 20530
prospecting in Australia, 16: 20044 (NP-11606)
prospecting in Chile, 16: 20820 (RME-4568)
prospecting in Peru, 16: 20818 (RME-4517)
prospecting in Peru, 16: 20819 (RME-4521)
recovery from MTR fuel elements by solvent extraction, 16: 20537(R) (ORNL-TM-177)
recovery from spent fuels by hydrochlorination and volatilization, 16: 20042(R) (BNL-696)
separation from elements with atomic numbers 89 to 95 by paper chromatography, 16: 20340
separation from fission products, 16: 20544
separation from irradiated fuels, progress on Eurochemic program, 16: 20539(R) (ORNL-TM-246)

separation from monazites, 16: 20343
separation from nitric acid solutions by adsorption on ion-exchange resin, effects of alcohol, 16: 20548
surface texture, determination of pole figures by reflection method, 16: 21017 (AE-68)
URANIUM (Zr ALLOY CLAD)
radiation effects, 16: 21810(R) (DP-725)
URANIUM CARBIDES
diffusion of inert gases in, 16: 21048(T,R) (EURAEC-18)
diffusion of xenon in, 16: 21047(T,R) (EURAEC-17)
diffusion of xenon in, 16: 21049(T,R) (EURAEC-121)
extrusion, evaluation of conditions for, 16: 20952(T,R) (EURAEC-71)
fabrication and radiation effects, 16: 20998(T,R) (EURAEC-220)
fabrication and radiation effects, 16: 20999(T,R) (EURAEC-247)
sintering, evaluation of conditions for, 16: 20952(T,R) (EURAEC-71)
URANIUM(IV) CHLORIDES
spectra of crystalline, 16: 20305(R) (UCRL-10023)
URANIUM COMPOUNDS
analysis for sodium, spectroscopic, 16: 20525(R) (MCW-1472)
URANIUM(IV) FLUORIDES
analysis for water, thermal conductometric, 16: 20525(R) (MCW-1472)
conversion to hexafluoride, 16: 20531(P)
meson (μ^-) capture probabilities, 16: 21174
preparation by fluorination of uranium dioxide powder, 16: 20432
URANIUM(VI) FLUORIDES
production from tetrafluoride, 16: 20531(P)
separation, construction of distillation column for, 16: 20541(T,R) (EURAEC-24)
URANIUM IONS
oxidation and reduction, effects of current composition and medium, 16: 20353(R) (EURAEC-241)
URANIUM(IV) IONS
sorption on paper impregnated with ion-exchange resins, 16: 20341
URANIUM ISOTOPES U-232
separation from isotope mixtures, theory, 16: 20924 (TID-15054)
URANIUM ISOTOPES U-233
electron emission, delayed-coincidence spectra, 16: 21438
neutron capture-to-fission ratio, 16: 21372
neutron total cross sections at 3.4 to 1611 kev, 16: 21373
production from thorium, 16: 20553(P)
URANIUM ISOTOPES U-234
fission, probability of emission of long-range particles, 16: 21420
URANIUM ISOTOPES U-235
criticality in cellulose sheets, 16: 21258
fission by neutrons at 14.7 Mev, light mass yields from, 16: 21347 (AWRE-0-58/61)
fission, probability of emission of long-range particles, 16: 21420
fission ratio changes near 0.284 ev, 16: 21839(R) (IDO-16760)
production and market status, 16: 20936
URANIUM ISOTOPES U-236
fission, probability of emission of long-range particles, 16: 21420
URANIUM ISOTOPES U-238
neutron resonance integrals, effects of nonuniform temperature distributions, 16: 21340
URANIUM LEACH SOLUTIONS (ACID)
reuse of waste in mills to prevent pollution from, 16: 21859 (BM-RI-6011)
URANIUM MINERALS
acid leaching studies of Spanish, 16: 20526
book: *Thermal Studies of Uranium and Uranium-Bearing Minerals*, 16: 20853
occurrence and structure of asturian pseudocrystals, 16: 20834
occurrence of uranium-bearing christobalite and tridymite in limestone, 16: 20824
URANIUM NITRIDES
crystal structure of U_2N_3, 16: 20396
URANIUM ORE PROCESSING PLANTS
safety hazards, 16: 20893
waste solution reuse to prevent pollution in, 16: 21859 (BM-RI-6011)
URANIUM(IV) OXIDE COMPACTS
diffusion of promethium-147, zirconium-95, and yttrium-91 in, 16: 21046(T) (AEC-tr-5171)
sintering, 16: 21819 (TID-15373)
sintering of dense, continuous, 16: 21002(P)
URANIUM(IV) OXIDE CRYSTALS
preparation, 16: 20041(R) (BMI-1574(Del.))
URANIUM OXIDE POWDERS
fluidization technology, 16: 20541(T,R) (EURAEC-24)
URANIUM(IV) OXIDE POWDERS
characterization and sinterability, 16: 20961(R) (UNC-1001)
fluorination, 16: 20432
URANIUM OXIDES
chlorination retreatment, 16: 20541(T,R) (EURAEC-24)
diffusion of xenon in, 16: 21047(T,R) (EURAEC-17)
electrolysis in fused fluorides at 1150°C, preparation of high-purity uranium in, 16: 20527
reduction to metal, electrolytic, 16: 20525(R) (MCW-1472)
reduction with hydrogen, phase changes in, 16: 20528
URANIUM OXIDES (STAINLESS STEEL CLAD)
fabrication by swaging, 16: 20997(T,R) (EURAEC-10)
URANIUM OXIDES (Zr ALLOY CLAD)
fabrication by swaging, 16: 20997(T,R) (EURAEC-10)
URANIUM(IV) OXIDES
development for use in water-cooled reactors, 16: 20951(R) (CEND-149)
diffusion of inert gases in, 16: 21048(T,R) (EURAEC-18)
diffusion of xenon in, 16: 21049(T,R) (EURAEC-121)
fabrication by swaging, 16: 20997(T,R) (EURAEC-10)
fission product diffusion in sintered, 16: 21091(R) (EURAEC-248)
fission products release from irradiated, mechanisms for gaseous, 16: 21043(T) (AEC-tr-5103)
fluorination, development of methods for, 16: 20298(R) (ANL-6477 (p.106-54))
oxidation kinetics, 16: 20541(T,R) (EURAEC-24)
sintering in steam atmosphere, 16: 20996(T,R) (EURAEC-2)
URANIUM(IV-VI) OXIDES
reduction kinetics, 16: 20541(T,R) (EURAEC-24)
URANIUM PERCHLORATES
complexes with dimethylacetamide and its trihydrate, preparation, 16: 20420
URANIUM SULFIDES
synthesis at high pressure, 16: 21112(R) (AD-266009)
URANIUM–ZIRCONIUM ALLOYS (Zr ALLOY CLAD)
dissolution and processing of irradiated, 16: 20534(R) (IDO-14574)
URANIUM–ZIRCONIUM ALLOYS (Zr CLAD)
fabrication into tubular fuel elements by extrusion, 16: 21001
URANYL COMPOUNDS
reactions with sodium hydroxide, 16: 20368(T) (AEC-tr-4457(p.98-107))
spectra, vibrational structure of electronic absorption, 16: 20449
URANYL IONS
reactions with alkali metal ferrocyanides, 16: 20367(T) (AEC-tr-4457 (p.69-79))
separation from aqueous solutions by cellulose, lignin, oxycellulose, and wood, 16: 20090
URANYL NITRATES
hydrolysis of aqueous solutions, acid extraction by amine, 16: 20434
reduction to ammonium and sodium uranous fluorides, pilot plants for, 16: 20530
solvent partition by TBP, 16: 20542(T) (TRG-Inf-Ser-42)
URANYL OXALATES
photodecomposition, development of actinometer using, 16: 20493
URANYL PHOSPHATES
distribution in amsco–tributylphosphate–nitric acid systems, 16: 20535(R) (IDO-14583)
UREA, [3-(CHLOROMERCURI)-2-METHOXYPROPYL]-
excretion, tracer study, 16: 20113
URINE
radiation effects on levels of corticosteroid and glucose, whole-body or partial-body exposure, 16: 20209
UTERUS
radiotherapy of cervix cancer, effects on endometrium, 16: 20158
radiotherapy of cervical cancer, resistance, 16: 20174
radiotherapy of sarcomas, 16: 20092
sodium-24 disappearance from, during normal and toxemic pregnancy, 16: 20116

V

VACUUM FURNACES
characteristics for metal production, 16: 20967
VACUUM SEALS
design of ceramic-to-metal and metal-to-metal, 16: 20566 (IFA/TV/14)
VACUUM SYSTEMS
uses in chemical engineering, 16: 20315
VACUUM TECHNIQUES
development, 16: 20315
for production of metals, 16: 20967
VAGINA
radiotherapy of cancer, response, 16: 20057
VALVES
design for fluid flow control, 16: 20623(P)
design of safety, for contaminated reactor gases, 16: 21761(P)
performance of remote bellows-seal air-actuated and solenoid-actuated types flow measurement and sampling, 16: 20631 (CVNA-140)
VAN ALLEN RADIATION BELTS
characteristics, 16: 20235
dosage measurements, 16: 20240
geomagnetic field fluctuation effects on, 16: 21245
VAN DE GRAAFF ACCELERATORS
beams, energy resolution improvement method, 16: 21642 (AD-267612)
pulsing equipment design, 16: 20472(R) (RRL-79)
VANADIUM
alloying effects on strain-aging in niobium alloys, 16: 21063
alpha and carbon-12 reactions, gamma distributions from, 16: 21457
brittle-ductile transition, 16: 21068
determination as trace in standard rocks G-1 and W-1, spectrographic, 16: 20831
neutron scattering, velocity distributions in, 16: 21333 (CRRP-1078)
uptake and distribution in *Ciona intestinalis*, 16: 20119
VANADIUM BRONZE
magnetic resonance in lithium, 16: 21123 (AFOSR-1959)
VANADIUM COMPLEXES
with 3-cyanopentane-2,4-dione, stretching frequency of cyano group in, 16: 20421
VANADIUM ISOTOPES V-51
deuteron reactions (d,p) at 15 Mev, angular dependence of proton polarization, 16: 21597
fluorine isotope reactions (F^{19},F^{18}) up to 43 Mev, 16: 21428
neutron reactions (n,d), angular distributions from, 16: 21554
proton reactions (p,α) at 18 Mev, seniority wave function effects on angular distributions and cross sections, 16: 21578
proton reactions (p,$\alpha\gamma$), cross sections and excitation functions, 16: 21526
VANADIUM OXIDES
catalytic effects on deuterium-hydrogen exchange, 16: 20433
radiation effects on films, on glass, 16: 21108
VANADIUM SILICIDES
heats of formation, 16: 20394
VELA PROJECT
developments to July 1961, 16: 20855
developments to July 1961, 16: 20854
VENTILATION
for clean rooms, system design, 16: 20874 (SC-4673(RR))
VESSELS
fabrication for liquids to be irradiated, 16: 20574
VIRUSES
effects of ultraviolet radiation on physical properties of ribonucleic acid, 16: 20150
radiation effects on poliovirus yield in cultured kidney cells from rhesus monkey, 16: 20201
radiation effects on infection by and immunity to, 16: 20227
VOLATILITY SEPARATION PROCESSES
development, removal of chloride from Zircex off-gas, 16: 20537(R) (ORNL-TM-177)

W

WASTE DISPOSAL
ion exchange, use of natural earth materials, 16: 20535(R) (IDO-14583)
laws, West Germany, 16: 21864
survey for clinical and biological applications, 16: 20904
WASTE PROCESSING
by coagulation and ion exchange, 16: 21863
calcination, development, 16: 20534(R) (IDO-14574)
calcination in fluidized beds, 16: 20535(R) (IDO-14583)
flocculation of solutions, 16: 21862
ion exchange, 16: 21865
methods allowing reuse of acid leach solution within mill, 16: 21859 (BM-RI-6011)
methods, review, 16: 20314
of high- and low-level materials, 16: 20537(R) (ORNL-TM-177)
research progress at Argonne National Lab., October to December 1961, 16: 20296(R) (ANL-6477)
WASTE SOLUTIONS
evaporation, design of system for, 16: 21861
WATER
analysis for deuterium, mass spectrometric, 16: 20333
boiling from mercury surface, nucleate, 16: 20617
boiling, hydrodynamic model for nucleate pool, 16: 20605
boiling on mercury and metal surfaces, nucleate, 16: 20618
effects on radiolytic formation of hydrogen from silane, 16: 20478
fission product content in drinking, in England, 16: 20126
gamma absorption coefficients at 0.14 to 2.76 Mev, 16: 21695
heat transfer in boiling, effects of induced vortices on burnout flux, 16: 20598(T) (EURAEC-146)
neutron scattering law, 16: 21331 (AERE-R-4019)
neutron scattering, velocity distributions in, 16: 21333 (CRRP-1078)
neutron scattering cross section, constants for approximation functions, 16: 21342
neutron scattering at low energies, calculation of angular distribution, 16: 21343
particle transport on ideal surface at 0.08 slope, 16: 20594 (USNRDL-TR-436)
positron annihilation in, 15-kgauss magnetic field effects, 16: 21175
radiation chemistry, precursors of molecular hydrogen formed in, 16: 20505
radiolysis G values, 16: 20514
radiolysis kinetics, analysis, 16: 20521
shear transmission, 16: 20557 (AD-269396)
WATER-*d*,
leakage from mechanical pumps, 16: 20564 (DP-666)
neutron scattering law, 16: 21331 (AERE-R-4019)
production and market status, 16: 20936
production by catalytic isotope exchange with hydrogen, 16: 20927(P)
production by the electrolytic method, 16: 20926
radiolysis G values, 16: 20514
WATER-*t*,
deposition at Chalk River in snow, 16: 20858 (AECL-1518)
WATER COOLED REACTORS
coolant radioactivity from contamination by dissolved radionuclides, 16: 21717 (DP-682)
design of heavy water-moderated steam-cooled pressure tube, 16: 21757(P)
fuel elements, development of uranium dioxide, 16: 20951(R) (CEND-149)
fuel elements, heat transfer in cylindrical, 16: 21712 (AEEW-R-96)
WATER MODERATED REACTORS
analysis and feasibility of thermoelectric direct-conversion, 16: 21791 (AD-267442)
decontamination, chemicals and procedures for, 16: 20984
design and characteristics of closed-cycle boiling, 16: 21786(P)
WATER SUPPLIES
monitoring for radioactivity, 16: 20889
monitoring for radioactivity, 16: 20901
monitoring, 1961, 16: 20906
monitoring, 1961 and 1962, 16: 20907
radioactivity, in Prague, 16: 20878(T) (AECL-1498)
radiological monitoring, 1961, 16: 20905
WATER VAPOR
deuterium-hydrogen exchange in, kinetics of, 16: 20923 (NP-11789)
WAVE MECHANICS
admissibility conditions from quantum mechanical principles, 16: 21163
book: *On Theory of Radiation in Matrix Form. Theory of Crystal Diode*, 16: 21709

Coulomb function, form for continuum-state relativistic, 16: 21165
WELDING
bibliography on pressure, 1944 to 1961, 16: 20995 (NP-11776)
electron beam, principles and apparatus design, 16: 21000
WELL LOGGING
equipment design for lunar probes, 16: 20659
equipment, design of heat-insulated radiation counter, 16: 20697(P)
gamma instrument for measuring density of formations, 16: 20698(P)
neutron-gamma system with calibration means, 16: 20699(P)
neutron method for determining points of entry of different liquids, 16: 20919(P)
WOLLASTONITES
crystal structure and symmetry of strontium germanate as model for α-, 16: 20441
WOOD
density determination for radioactive containers, 16: 20861 (AHSB(S)R-36)
WOUNDS
effects of whole-body irradiation on healing, in rats, 16: 20289

X

X RADIATION
absorption, temperature effects on extended fine structure, 16: 21126 (D1-82-0164)
biological effects on leukocytes in patients, protective effects of dexamethasone against, 16: 20269
biological effects on mice infected with lymphocytic choriomeningitis, 16: 20271
biological effects on mice infected with lymphocytic choriomeningitis, 16: 20272
biological effects on spleen cells in mice, 16: 20274
biological effects on antibody formation in rabbits, 16: 20275
biological effects on skin graft take and immune response in rabbits, 16: 20276
biological effects on blood platelets in mice, 16: 20277
biological effects on body temperature in rabbits, 16: 20279
biological effects of lethal irradiation on bone marrow and spleen, protective effects of desoxyribonucleic acid, 16: 20283
biological effects on gonads in male mice, protective effects of unsaturated fatty acid esters against, 16: 20285
biological effects on ultraviolet-thrombopoietic factor in mice, 16: 20290
biological effects on erythrocyte transmission across mouse placenta, radiation effects, 16: 20066
biological effects on transmission of maternal serum albumin to fetus in mice, 16: 20067
biological effects on *Trichinella spiralis*, 16: 20135
biological effects on immunogenicity of *Trichinella spiralis* larvae, 16: 20137
biological effects on ovary grafts in eyes of mice, 16: 20139
biological effects on adrenergic transmission and nictitating membrane in cats, 16: 20143
biological effects on resorption time of cutaneous wheals, 16: 20145
biological effects on hair, protective effects of erotonin against, 16: 20162
biological effects on leg buds of chick embryos, 16: 20164
biological effects on metabolism of Yoshida ascites hepatoma cells, 16: 20194
biological effects on *Schistosoma mansoni* cercariae, 16: 20202
biological effects on tritium incorporation in brain and liver of mice, 16: 20221
biological effects on rat testes, comparison of single and fractionated doses, 16: 20225
biological effects on liver in rat, effects of adrenal hormones, 16: 20247
biological effects on anaphylaxis in guinea pig, 16: 20252
biological effects on mice, protective effects of spleen cells against, 16: 20263
biological effects of radiotherapeutic doses on blood, 16: 20264
biological effects of diagnostic doses on reproductive function of women, 16: 20265
biological effects on immune responses of mice, 16: 20267
biological effects on tumor metastasis in mice, 16: 20268
cataract development in frogs and mice caused by wounds after, 16: 20200
chemical effects on polyvinyl acetate, dependence on linear energy transfer, 16: 20501
detection and measurement of scattered, during dental radiography, 16: 20884
detection and measurement, sensitivity of Geiger-Mueller counter for, 16: 20656
dosage determinations by detector using radioinduced polymerization, 16: 20857(R) (AD-265757)
effect on homozygous yeast, 16: 20226
effects of whole-body or partial-body exposure on urinary excretion of corticosteroid and glucose, 16: 20209
effects on alterations in deoxyribonucleic acid from regenerating rat liver, in vivo, 16: 20199
effects on anomalies in interkinetic nuclei, 16: 20215
effects on bacteriophages, effects of cysteamine and cysteine on, 16: 20293
effects on blood retraction, 16: 20205
effects on breast development, 16: 20170
effects on cellulose-decomposition activity of rumen bacteria, 16: 20206
effects on culture media, 16: 20204
effects on hypophysectomized and normal rats treated with sex hormones, 16: 20185
effects on microcirculation in kidneys, 16: 20214
effects on poliovirus yield in cultured kidney cells from rhesus monkey, 16: 20201
effects on tumor growth and regression, whole-body and tumor-directed exposure, 16: 20131 (UR-575)
effects on T1 phages, effects of cysteamine and glycerine on, 16: 20294
effects on T2 bacteriophages, effects of cysteamine on, 16: 20292
effects on urinary excretion of noradrenalin or adrenalin by rats, 16: 20173
filters for, properties of, 16: 20086
genetic effects in Drosophila, 16: 20175
genetic effects in Drosophila, 16: 20176
genetic effects on somatic mutations in meal moth, at low doses, 16: 20281
genetic effects on rice, 16: 20179
genetic effects on spermatogonia and spermatozoa of *Drosophila melanogaster*, 16: 20197
genetic effects on fertility, deformities, postnatal and infant mortality, and sex ratio in mice, 16: 20220
genetic effects on populations by dermatological therapy using, 16: 20223
genetic effects on *Sciara coprophilia*, sex-linked recessive lethal mutations, 16: 20138
histological modifications of testicles after irradiation of salivary glands, 16: 20216
histological modifications of ovaries after irradiation of salivary glands, 16: 20217
induced by Sept. 28, 1961 solar flare, high altitude distribution, 16: 21238 (NP-11658)
lethal effects on rats, effects of oxygen consumption during irradiation, 16: 20280
lethal effects on *Escherichia freundii*, protective effects of fluoroacetate against, 16: 20144
mutagenic effects on leaf color, 16: 20207
mutagenic effects on plants, 16: 20208
protective effects against arrhythmia induced by adrenaline and noradrenaline in anesthesized dogs, 16: 20218
sarcoma induction by therapy of cerebral tumor, 16: 20171
X-RAY EQUIPMENT
scattering reduction in therapeutic machines, 16: 20569
X-RAY MONOCHROMATORS
design and performance of curved-crystal, 30- to 250-kev, 16: 21443
X-RAY SPECTROSCOPY
use to determine protein-bound iodine in human serum, 16: 20331
XENON
content in nuclear reactor, equations and phase-plane for determining, 16: 21741

diffusion in thorium dioxide, uranium carbide, and uranium dioxide, 16: 21049(T,R) (EURAEC-121)
diffusion in uranium carbides and oxides, 16: 21047(T,R) (EURAEC-17)
ionization by electrons at 150 to 550 Mev, 16: 21288
reactor poisoning, effects on shutdown behavior, 16: 21738
spectra, excited by alpha and electron impacts in pure, 16: 21147

XENON ISOTOPES Xe-133
use in studying pulmonary function of various regions of lung, 16: 20055

Y

YANKEE POWER REACTOR
operation data availability, 16: 21816 (NYO-2482)

YEASTS
radiosensitivity, effect of mutated alleles, 16: 20226
ribosomes, effects of nutrition, 16: 20103
toxic effects of intermediate oxidation products of oleic acid, similarity to gamma ray effects, 16: 20063

YTTERBIUM ISOTOPES
nuclear gyromagnetic ratios and quadrupole moments, 16: 21446

YTTERBIUM ISOTOPES Yb-170
energy levels, lifetimes, 16: 21440
gamma spectra, E2 emission parameters, 16: 21444

YTTERBIUM ISOTOPES Yb-171
gamma spectra, E2 emission parameters, 16: 21444

YTTERBIUM ISOTOPES Yb-173
gamma spectra, E2 emission parameters, 16: 21444

YTTERBIUM ISOTOPES Yb-176
gamma spectra, E2 emission parameters, 16: 21444
neutron capture cross sections, 16: 20302(R) (ANL-6477(p.217-23))

YTTRIUM
determination as trace in standard rocks G-1 and W-1, spectrographic, 16: 20831
determination in chondrites and sediments, activation, 16: 20841
separation from rare earths by cation exchange, 16: 20554(P)

YTTRIUM IONS
diffusion in bentonite clay-water pastes, self-, 16: 20425
exchange on natural and synthetic exchangers, 16: 20356 (JÜL-32-RC)

YTTRIUM ISOTOPES Y-83
photon scattering at 4 to 24 Mev, cross sections for inelastic, 16: 21641

YTTRIUM ISOTOPES Y-88
gamma spectra, 16: 20628 (ANL-6499)

YTTRIUM ISOTOPES Y-89
proton reactions (p,pα) at 20 to 155 Mev, excitation functions for, 16: 21484

YTTRIUM ISOTOPES Y-90
applications of injected, in treatment of multiple myeloma, 16: 20070
energy levels, 16: 21352 (NP-11667)

YTTRIUM ISOTOPES Y-91
diffusion in uranium (IV) oxides, 16: 21046(T) (AEC-tr-5171)

Z

ZEPHYR
design, 16: 21732

ZEUS
design, 16: 21732

ZINC
alloying effects on nuclear spin-lattice relaxation of aluminum at 0.37 to 1.2°K, 16: 21184
alpha scattering at 43 Mev, excitation of collective levels by inelastic, 16: 21514
content in human serum and muscles, 16: 20098
determination in chicken by neutron activation, 16: 20337
deuteron reactions (d, helium-3) at 21.6 Mev, determination of configurations of states by, 16: 21562
hyperfine structure, 16: 21129(R) (NP-11640)
properties evaluation for coating niobium, 16: 21031 (DC-60-8-25)

ZINC COMPLEXES
with 3-cyanopentane-2,4-dione, stretching frequency of cyano group in, 16: 20421

ZINC FLUORIDES
decomposition voltage at 1100°C in calcium fluoride–thorium fluoride melts, 16: 20966

ZINC ISOTOPES Zn-64
neutron reactions (n,2n), excitation functions for, 16: 21352 (NP-11667)
neutron reactions (n,2n) and (n,p) at 13.8 to 14.8 Mev, cross sections and isomeric ratios for, 16: 21385

ZINC ISOTOPES Zn-67
Mössbauer effect on 92-kev transition, 16: 21362(T) (AEC-tr-5115)

ZINC ISOTOPES Zn-72
yield from neutron fission of uranium-235, 16: 21347 (AWRE-0-58/61)

ZINC OXIDE FILMS
radiation effects on, applied to glass, 16: 21108

ZINC OXIDES
radiation effects on catalytic activity for ethanol dissociation, 16: 20509
radiation effects on reactions with methanol, 16: 20516

ZINC SELENIDES
imperfection ionization energies and photoelectronic properties, 16: 21222

ZINC SULFIDE CRYSTALS
luminescence buildup and decay of copper-activated, 16: 21150
surface structure of unactivated and copper-activated, effects of darkening in moist air, 16: 20477

ZINC SULFIDES
electroluminescence in castor wax and tricresyl phosphate matrices, effects of polarization, 16: 20470(R) (NP-11604)
imperfection ionization energies and photoelectronic properties, 16: 21222

ZINC TELLURIDES
imperfection ionization energies and photoelectronic properties, 16: 21222

ZIRCONIUM
alloying effects on strain-aging in niobium alloys, 16: 21063
corrosion by acids and chloride salts in chemical plants, 16: 20983
determination as trace in standard rocks G-1 and W-1, spectrographic, 16: 20831
diffusion of hydrogen in films on, at 200 to 700°C, 16: 21035 (NAA-SR-6267)
dissolution by hydrofluoric acid, flowsheets, 16: 20535(R) (IDO-14583)
ion exchange on Radgendorf clay, 16: 21865
properties as x-ray filter, 16: 20086
purification by electrolysis, 16: 20969(P)
radiation damage, 16: 21086 (AECL-1484)
separation from hafnium by solvent extraction from hydrochloric acid and nitric acid solutions, 16: 20545
sorption of hydrogen by, comparison of reaction kinetics of hafnium, 16: 21064
thermal cycling, microstructural changes during, 16: 21059
thermodynamics in potassium chloride (liquid), oxygen equilibrium potential diagram for, 16: 20426

ZIRCONIUM ALLOYS
corrosion by steam and water, 16: 20973(R) (ARF-2198-18)
corrosion, effects of impurities and oxide film behavior, 16: 20954(R) (NMI-2104)
corrosion, fundamental study, 16: 20955(R) (NMI-2105)
corrosion, relation of hydrogen pickup to oxide layer structure in, 16: 20979 (HW-71958-RD)

ZIRCONIUM ANTIMONATES
ion exchange properties for cations, 16: 20403

ZIRCONIUM BROMIDES
magnetic properties at 80 to 300°K, 16: 20423

ZIRCONIUM CHLORIDES
magnetic properties at 80 to 300°K, 16: 20423

ZIRCONIUM DEUTERIDES
heat of formation, 16: 20299(R) (ANL-6477(p.155-67))

ZIRCONIUM HYDRIDES
heat of formation, 16: 20299(R) (ANL-6477(p.155-67))

ZIRCONIUM IODIDES
magnetic properties at 80 to 300°K, 16: 20423

ZIRCONIUM ISOTOPES Zr-90
neutron reactions (n,p) at 14.7 Mev, cross sections, 16: 21352 (NP-11667)

ZIRCONIUM ISOTOPES Zr-91

energy levels, determination of neutron, 16: 21495
ZIRCONIUM ISOTOPES Zr-93
energy levels, determination of neutron, 16: 21495
ZIRCONIUM ISOTOPES Zr-95
content in drinking waters in England, 16: 20126
determination in shore sand and sea silt, gamma-spectrometric, 16: 20323 (PG-Report-312)
diffusion in uranium (IV) oxides, 16: 21046(T) (AEC-tr-5171)
energy levels, determination of neutron, 16: 21495
separation from waste solutions by flocculation, 16: 21862
sorption by stainless steel in boiling-water reactor, 16: 20303(R) (ANL-6477(p.224-30))
ZIRCONIUM MOLYBDATES
cation exchange properties, 16: 20356 (JÜL-32-RC)
ZIRCONIUM NITRATES
concentration of aqueous solutions without precipitation of zirconium, 16: 20465(P)
ZIRCONIUM OXIDE FILMS
radiation effects on, applied to glass, 16: 21108
ZIRCONIUM OXIDES
hydrogen pickup in layer structure of corrosion product, 16: 20979 (HW-71958-RD)
ZIRCONIUM PHOSPHATES
cation exchange properties, 16: 20356 (JÜL-32-RC)
ZIRCONIUM SILICIDES
heats of formation, 16: 20394
ZIRCONIUM TUNGSTATES
cation exchange properties, 16: 20356 (JÜL-32-RC)
ZIRCONS
conversion into concentrated aqueous zirconium nitrate solutions, 16: 20465(P)
ZIRFLEX PROCESS
hot cell demonstration with PWR blanket rods, 16: 20537(R) (ORNL-TM-177)

REPORT NUMBER INDEX

All reports, translations, and patents abstracted in this issue are included in this index. Each item is listed by report number; this is followed by the abstract number and a brief notation regarding public availability. The index entries show, when known, which reports are on file in the depository libraries, which reports have been published in open-literature journals (journal citation given), and which reports can be purchased (source and price). Whenever a report is identified by more than one number, cross references from secondary to primary report numbers are cited.

The report number codes apply to AEC reports unless designated otherwise. Non-AEC reports are identified by parenthetical notes after the report codes; e.g., (non-AEC), (British), (Canadian), (French). The note (Misc.) identifies those codes used for both USAEC and non-AEC reports. The report numbers for the non-AEC reports in these series are marked with an asterisk (*). Patents are listed under the heading "PATENTS"; the country of origin is included in parentheses.

A comprehensive listing of both AEC and non-AEC report codes is contained in TID-85(2nd Rev.), *Report Number Series Used by the Technical Information Service in Cataloging Reports*. March 1960, $2.75 (OTS), and supplement, August 1960, $0.50 (OTS).

Public Availability of USAEC Reports

All USAEC reports abstracted in *NSA* are available to the public through one or more of the following sources:

(1) Depository libraries in the United States, in other countries, and in international agencies. A list of these depositories, many of which have facilities for preparing photocopy for sale, appears on the inside covers of each issue of *NSA*.

(2) Scientific and technical journals or other publications.

(3) Microcard Editions, Inc., in Microcard form. Orders and inquiries should be sent to: Accounting and Shipping Department, West Salem, Wisconsin.

(4) Office of Technical Services, U. S. Department of Commerce, Washington 25, D. C., for sale as full-size printed copy, photostat or facsimile (Xerox), and microfilm.

(5) Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C., for sale as full-size printed copy.

Public Availability of Non-AEC Reports

U. S. Reports. Many reports of U. S. Government agencies other than the AEC can be obtained by the public in the same manner as AEC reports. The availability of these reports is given when known. If availability is not shown, inquiries should be directed to the Office of Technical Services. Inquiries concerning "NP" reports should be by title and author rather than by NP number.

Non-U. S. Reports. Many reports of atomic energy establishments of other countries are placed in the depository libraries in the United States, where they are available for public use. Other reports appear in the journal literature. Some British reports are sold by the British Information Service, 45 Rockefeller Plaza, New York 20, N. Y. Some Canadian reports are sold by Atomic Energy of Canada Ltd., Chalk River, Ontario, Canada. This index identifies any type of public availability known to the USAEC.

Abbreviations Used in Availability Column

AECL	For sale by Atomic Energy of Canada Ltd., Chalk River, Ontario, Canada.
BIS	For sale by the British Information Service, 45 Rockefeller Plaza, New York 20, N. Y.
Dep.	AEC reports: Full-size copy is on deposit in the depository libraries both in and outside the United States. These reports are also for sale by Microcard Editions, Inc., Accounting and Shipping Department, West Salem, Wisconsin. Non-AEC reports: Full-size copy on deposit in the depository libraries in the United States only.
Dep.(mc)	Same as for Dep., except copy is in Microcard form.
DSIR	For sale by the Department of Scientific and Industrial Research, Lending Library Unit, 20 Chester Terrace, London, N. W. 1, England.
DTI Extension	Available from the U. S. Atomic Energy Commission, Division of Technical Information Extension, P. O. Box 62, Oak Ridge, Tennessee.
GPO	For sale by the Superintendent of Documents, Government Printing Office, Washington 25, D. C.
IAEA	Available from the International Atomic Energy Agency.
JCL	For sale by the Special Libraries Association Translation Center, John Crerar Library, 86 E. Randolph Street, Chicago 1, Illinois.
NRC	For sale by the National Research Council of Canada, Ottawa, Ontario, Canada.
OTS	For sale by the Office of Technical Services, Department of Commerce, Washington 25, D. C.
USGS	Available free-of-charge from the U. S. Geological Survey, Washington 25, D. C.

(The symbols "ph," "mf," and "fs" are used to designate that copy is available only in photostat, microfilm, or facsimile (Xerox) form.)

Report No.	Abstract No.	Availability
NUMERICAL	**(Misc.)**	
8937-60[illegible]-CU-000*	16-20567	See NP-11533
8987-0001-RU-000*	16-21093	See NP-11655
A-AC–	**(Misc.)**	
82/G/L.711*	16-20812	
82/G/L.721*	16-20813	
82/G/L.746	16-20856	Dep.(mc)
AAEC/E–	**(Australian)**	
85	16-20555	Dep.(mc)
87	16-20928	Dep.(mc)
AD–	**(Misc.)**	
230373*	16-21007	
237966*	16-21109	
251485*	16-21110	
263476*	16-21844	OTS
263483*	16-21008	
264815*	16-21009	OTS
264878*	16-21010	
264988*	16-21011	OTS
265106*	16-21111	OTS
265328*	16-21012	
265757*	16-20857	OTS
265829*	16-21658	OTS
265927*	16-20625	OTS
266009*	16-21112	OTS
266034*	16-21845	OTS
266071*	16-21357	See RADC-TR-61-132
266094*	16-21013	OTS
266097*	16-21014	OTS
266116*	16-21015	OTS
266140*	16-21016	OTS
266150*	16-20971	OTS
266197*	16-21113	
266249*	16-20987	OTS
266251*	16-20989	See ASD-TN-61-32
266424*	16-21019	See ARF-2212-5
266765*	16-21850	OTS
266876*	16-20991	See ASD-TR-7-647(VI)
267135*	16-21659	OTS
267330*	16-21849	See WADD-TR-60-698(Pt.I)
267391*	16-21661	See AFCRL-746
267442*	16-21791	OTS
267458*	16-21114	OTS
267458(Pt.I)*	16-21115	
267458(Pt.V)*	16-21116	
267561L*	16-21690	
267612*	16-21642	
267646*	16-21330	OTS
267838*	16-21018	See AFOSR-1416
268695*	16-21846	
269307*	16-20626	OTS
269326*	16-21117	OTS
269392*	16-20556	OTS
269396*	16-20557	OTS
269397*	16-20558	OTS
270433*	16-21651	See SIT-P53
271170*	16-21660	OTS
271462*	16-20860	See AFSWP-792
AE–	**(Swedish)**	
68	16-21017	Dep.(mc)
AEC-tr–		
4434	16-20362	Dep.; $1.00(OTS)
4457	16-20364	Dep.; $3.75(OTS)
5048	16-21140	Dep.(mc); $1.10(fs), $0.80(mf) JCL
5063	16-21141	Dep.(mc); $3.60(fs), $1.19(mf) JCL
5082	16-20473	Dep.(mc); $2.60(fs), $0.83(mf) JCL or OTS
5100	16-20375	Dep.(mc); $1.10(fs), $0.80(mf) JCL or OTS
5103	16-21043	Dep.(mc); $1.60(fs), $0.80(mf) JCL
5110	16-20376	$2.60(fs), $0.92(mf) JCL or OTS
5111	16-20377	$1.60(fs), $0.80(mf) JCL
5112	16-20378	Dep.(mc); $1.10(fs), $0.80(mf) JCL or OTS
5115	16-21362	Dep.(mc); $1.60(fs), $0.80(mf) JCL or OTS
5127	16-21044	Dep.(mc); $1.10(fs), $0.80(mf) JCL
5138	16-21045	Dep.(mc); $2.60(fs), $0.86(mf) JCL
5171	16-21046	Dep.(mc); $1.10(fs), $0.80(mf) JCL
AECL–	**(Canadian)**	
1458	16-21792	Dep.; $0.10(AECL)
1484	16-21086	Dep.; $1.00(AECL)
1494	16-21333	See CRRP-1078
1495	16-21793	Dep.; $1.00(AECL)
1498	16-20878	Dep.; $0.20(AECL)
1501	16-20304	See CRL-73
1507	16-20977	See CRGN-1082
1518	16-20858	Dep.; $0.50(AECL)
AEET-HP–	**(Indian)**	
4	16-21345	
AEET-RE–	**(Indian)**	
1	16-21710	Dep.(mc)
AEEW-M–	**(British)**	
220	16-21118	Dep.; $0.25(BIS)
225	16-21711	Dep.; $0.21(BIS)
AEEW-R–	**(British)**	
96	16-21712	Dep.; $0.63(BIS)
121	16-21713	Dep.
132	16-20627	Dep.; $0.35(BIS)
AERE-M–	**(British)**	
717	16-21340	J. Nuclear Energy, Pts. A & B, Reactor Sci. and Technol. 16: 235-6(1962)
770	16-20687	Phys. in Med. Biol. 6: 283-6(1961)
AERE-Memo–	**(British)**	
G/M-37	16-21643	
AERE-R–	**(British)**	
3409	16-20466	Dep.; $0.49(BIS)
3770	16-21102	Phil. Mag. (b), 7: 285-99(1962)
3775	16-21372	J. Nuclear Energy, Pts. A & B, Reactor Sci. and Technol. 16: 195-200(1962)
4019	16-21331	Dep.; $0.35(BIS)
4041	16-21332	Dep.; $0.49(BIS)
AERE-READING LIST–	**(British)**	
8	16-20859	Free(BIS)
AERE-Trans–	**(British)**	
893	16-21668	Dep.
AeroChemTP–	**(Non-AEC)**	
34	16-21659	See AD-267135
AFBSD-TR–	**(Non-AEC)**	
61-80	16-21119	
AFCRL–	**(Non-AEC)**	
62-294	16-21120	
746	16-21661	OTS
942	16-20589	
1062-I	16-21121	
1062-II	16-21122	
AFOSR–	**(Misc.)**	
1416*	16-21018	OTS
1564*	16-20589	See AFCRL-942
1959*	16-21123	
2352*	16-21847	
2400*	16-21698	
2409*	16-21260	
2483*	16-21087	
2674*	16-21124	
AFOSR-TR–	**(Non-AEC)**	
60-172	16-21261	
AFSWC-TDR–	**(Non-AEC)**	
62-42	16-21662	
AFSWP–	**(Misc.)**	
792*	16-20860	OTS
AGC–	**(Misc.)**	
0423-01-3*	16-20350	
0584-04-2*	16-20972	
AHSB(S)–	**(British)**	
R-36	16-20861	Dep.

Report No.	Abstract No.	Availability
AML-A–	**(British)**	
58(M)	16-20321	See NP-11608
AMP–	**(Non-AEC)**	
74	16-21847	See AFOSR-2352
ANL–		
6440	16-21714	Dep.; $1.00(OTS)
6477	16-20296	Dep.; $3.00(OTS)
6499	16-20628	Dep.; $2.00(OTS)
6510	16-20862	Dep.; $1.00(OTS)
6517	16-21125	Dep.; $8.10(fs), $2.72(mf) OTS
6565	16-21794	Dep.; $1.50(OTS)
ANL-FGF–		
294	16-20810	Nondestructive Testing 20: 185-92; 194(1962)
AOMC-RR–	**(Argentenia)**	
TR-62-1	16-21352	See NP-11667
ARF–	**(Misc.)**	
2198-18	16-20973	Dep.(nc); $1.60(fs), $0.80(mf) OTS
2212-5*	16-21019	OTS
2232-2*	16-20988	
8203-18*	16-21020	
ARL–	**(Non-AEC)**	
181	16-20805	$1.50(OTS)
185	16-21346	OTS
191	16-20351	OTS
240	16-21021	
62-310	16-21663	$2.75(OTS)
ASD-TDR–	**(Non-AEC)**	
62-25(Pt.I)	16-21022	
62-32(Pt.II)	16-20467	OTS
62-88	16-20590	OTS
ASD-TN–	**(Non-AEC)**	
61-32	16-20989	OTS
ASD-TR–	**(Non-AEC)**	
61-194	16-21023	OTS
61-383	16-21024	OTS
61-499	16-21025	OTS
7-532a(VI)	16-20990	
7-647(VI)	16-20991	OTS
7-783(III)	16-20992	
ATL-A–		
113	16-20591	Dep.(nc); $1.10(fs), $0.80(mf) OTS
AWRE-O–	**(British)**	
58/61	16-21347	Dep.
BAW–	**(Misc.)**	
154*	16-21715	
163*	16-21795	Dep.(nc); $4.60(fs), $1.67(mf) OTS
1215(and Suppl.1)	16-20863	Dep.(nc); $9.10(fs), $3.26(mf) OTS
1216	16-21257	Dep.(nc); $15.50(fs), $7.13(mf) OTS
BM-RI–	**(Misc.)**	
5980*	16-20950	Free (Bureau of Mines)
5994*	16-20468	Free (Bureau of Mines)
6011*	16-21859	Free (Bureau of Mines)
BMI–	**(Misc.)**	
1574(Del.)	16-20041	Dep.; $2.00(OTS)
BMI-X–		
198	16-20974	Dep.(nc); $1.60(fs), $0.80(mf) OTS
BN–	**(Non-AEC)**	
278	16-21665	See NP-11649
286	16-21124	See AFOSR-2674
BNL–		
696	16-20042	Dep.; $1.75(OTS)
699	16-20629	Dep.; $0.50(OTS)
728	16-20975	Dep.; $1.75(OTS)
5360	16-21737	J. Nuclear Energy, Pts. A & B, Reactor Sci. and Technol. 16: 205-7(1962)
5867	16-21424	Phys. Rev. 126: 1540-54(1962)
BW–	**(Misc.)**	
3871	16-20976	
C–	**(Misc.)**	
63270-02-1*	16-21845	See AD-266034

Report No.	Abstract No.	Availability
CEA–	**(French)**	
3748	16-20999	For translation see EURAEC-247
CEA-tr–	**(French)**	
A-1052	16-20910	Dep.(nc); $1.10(fs), $0.80(mf) JCL
A-1087	16-21142	Dep.(nc); $3.60(fs), $1.31(mf) JCL
R-1476	16-20474	Dep.(nc); $2.60(fs), $0.89(mf) JCL or OTS
R-1495	16-20925	Dep.(nc); $1.60(fs), $0.80(mf) JCL or OTS
R-1572	16-20880	Dep.(nc); $1.10(fs), $0.80(mf) JCL or OTS
X-434	16-20475	Dep.(nc); $1.60(fs), $0.80(mf) JCL
CEND–	**(Misc.)**	
149	16-20951	Dep.(nc); $4.60(fs), $1.70(mf) OTS
CERN–	**(European Organization for Nuclear Research)**	
62-1	16-20630	Dep.(nc)
62-4	16-21644	Dep.(nc)
62-8	16-21262	Dep.(nc)
62-14	16-21263	Dep.(nc)
62-15	16-21699	Dep.(nc)
62-19	16-21645	Dep.(nc)
COO–		
264	16-21817	See TID-7630
CRGM–	**(Canadian)**	
1082	16-20977	Dep.; $1.00(AECL)
CRL–	**(Canadian)**	
73	16-20304	Dep.; $0.20(AECL)
CRRP–	**(Canadian)**	
1078	16-21333	Dep.; $1.00(AECL)
CU–	**(Misc.)**	
3-62-SC-78330-Phys.*	16-21129	See NP-11640
CVNA–	**(Misc.)**	
114	16-21716	Dep.(nc); $12.50(fs), $5.42(mf) OTS
140	16-20631	$5.60(fs), $1.85(mf) OTS
D–	**(Misc.)**	
1-82-0155*	16-21664	
1-82-0163*	16-21032	
1-82-0164*	16-21126	
D-BIB–		
7	16-21652	See TID-15417
DASA–	**(Misc.)**	
1242*	16-20864	
DC–	**(Misc.)**	
55-6-7	16-21796	Dep.(nc); $15.50(fs), $7.22(mf) OTS
59-3-200	16-20352	Dep.(nc); $1.10(fs), $0.80(mf) OTS
59-5-41	16-20559	Dep.(nc); $4.60(fs), $1.64(mf) OTS
59-6-224 & Add.	16-21026	Dep.(nc); $2.60(fs), $1.10(mf) OTS
59-6-253	16-20560	Dep.(nc); $2.60(fs), $0.83(mf) OTS
59-6-743	16-20632	Dep.(nc); $5.60(fs), $1.88(mf) OTS
59-9-154	16-20561	Dep.(nc); $3.60(fs), $1.25(mf) OTS
59-10-202	16-20633	Dep.(nc); $2.60(fs), $1.01(mf) OTS
59-12-216	16-21027	$4.60(fs), $1.46(mf) OTS
60-1-108	16-21028	Dep.(nc); $2.60(fs), $0.95(mf) OTS
60-1-146	16-21029	Dep.(nc); $1.60(fs), $0.80(mf) OTS
60-3-110	16-21030	Dep.(nc); $3.60(fs), $1.13(mf) OTS
60-7-9	16-21691	$7.60(fs), $2.42(mf) OTS
60-8-25	16-21031	Dep.(nc); $1.60(fs), $0.80(mf) OTS
60-8-32	16-20562	$1.60(fs), $0.80(mf) OTS
60-12-98	16-21334	Dep.(nc); $1.60(fs), $0.80(mf) OTS
60-12-129	16-20563	Dep.(nc); $1.60(fs), $0.80(mf) OTS
DLCS–		
1500103	16-21797	Dep.(nc); $3.60(fs), $1.13(mf) OTS
1510108	16-21798	Dep.(nc); $1.60(fs), $0.80(mf) OTS
1510109	16-21799	Dep.(nc); $4.60(fs), $1.64(mf) OTS
1510205	16-21800	Dep.(nc); $1.10(fs), $0.80(mf) OTS
1690203	16-21860	Dep.(nc); $1.60(fs), $0.80(mf) OTS
1740405	16-21801	Dep.(nc); $1.10(fs), $0.80(mf) OTS
1800102	16-21802	Dep.(nc); $1.10(fs), $0.80(mf) OTS
1840402	16-21803	Dep.(nc); $1.10(fs), $0.80(mf) OTS
2130102	16-21804	Dep.(nc); $1.10(fs), $0.80(mf) OTS
2390301	16-21805	Dep.(nc); $1.10(fs), $0.80(mf) OTS
3170101	16-21806	Dep.(nc); $5.60(fs), $1.88(mf) OTS
3370103(Rev.)	16-21807	Dep.(nc); $5.60(fs), $1.79(mf) OTS

Report No.	Abstract No.	Availability
3440103	16-21808	Dep.(mc); $1.60(fs), $0.80(mf) OTS
3570105	16-21809	Dep.(mc); $1.10(fs), $0.80(mf) OTS
DM/CS–	**(French)**	
D/7027	16-21043	For translation see AEC-tr-5103
DOFL-TR–	**(Non-AEC)**	
1037	16-21088	
DP–		
666	16-20564	Dep.; $0.50(OTS)
682	16-21717	Dep.; $1.00(OTS)
683	16-20978	Dep.; $1.50(OTS)
692	16-20634	Dep.; $0.50(OTS)
725	16-21810	Dep.; $1.25(OTS)
DPR-INF–	**(British)**	
265	16-21089	Dep.(mc)
266	16-20865	Dep.(mc); Free(BIS)
DUBNA REPORTS	**(Russian)**	
See JINR (Russian)		
DXRL-AR–	**(New Zealand)**	
12	16-20866	Dep.(mc)
EOS–	**(Non-AEC)**	
1592-2M-2	16-21112	See AD-266009
1650-4M-2	16-21011	See AD-264988
ER–	**(Misc.)**	
4166*	16-21849	See WADD-TR-60-698(Pt.I)
EURAEC–		
2	16-20996	Dep.(mc); $3.60(fs), $1.13(mf) OTS
10	16-20997	Dep.(mc); $2.60(fs), $1.04(mf) OTS
17	16-21047	Dep.(mc); $1.10(fs), $0.80(mf) OTS
18	16-21048	Dep.(mc); $1.60(fs), $0.80(mf) OTS
24	16-20541	Dep.(mc); $10.50(fs), $4.22(mf) OTS
26	16-20980	Dep.(mc); $2.60(fs), $0.83(mf) OTS
27	16-20981	Dep.(mc); $5.60(fs), $1.85(mf) OTS
33	16-20596	Dep.(mc); $1.60(fs), $0.80(mf) OTS
35	16-21811	Dep.(mc); $2.60(fs), $0.98(mf) OTS
71	16-20952	Dep.(mc); $1.10(fs), $0.80(mf) OTS
85	16-20982	$3.60(fs), $1.25(mf) OTS
104	16-20591	See ATL-A-113
121	16-21049	Dep.(mc); $1.10(fs), $0.80(mf) OTS
138	16-20973	See ARF-2198-18
140	16-21090	Dep.(mc); $2.60(fs), $1.07(mf) OTS
144	16-20597	Dep.(mc); $8.10(fs), $2.66(mf) OTS
146	16-20598	Dep.(mc); $11.00(fs), $4.58(mf) OTS
208	16-20951	See CEND-149
220	16-20998	Dep.(mc); $2.60(fs), $1.04(mf) OTS
241	16-20353	Dep.(mc); $1.10(fs), $0.80(mf) OTS
247	16-20999	Dep.(mc); $4.60(fs), $1.43(mf) OTS
248	16-21091	Dep.(mc); $2.60(fs), $0.83(mf) OTS
264	16-20592	Dep.(mc); $3.60(fs), $1.16(mf) OTS
FN-E–	**(Italian)**	
16	16-20592	See EURAEC-264
FTD-TT–	**(Non-AEC)**	
61-23	16-21269	OTS
62-298	16-20599	OTS
62-480	16-20649	OTS
GA-Phys.–	**(Non-AEC)**	
61-6	16-21642	See AD-267612
GACD–	**(Non-AEC)**	
3001	16-21092	
GEMP–		
72	16-21718	Dep.; $1.00(OTS)
GNEC–		
230	16-21812	Dep.(mc); $6.60(fs), $2.24(mf) OTS
HPR–	**(Norwegian)**	
21	16-21813	Dep.(mc)
HW–		
19771	16-20354	$1.10(fs), $0.80(mf) OTS
70151	16-21033	Dep.; $0.50(OTS)
70351(Rev.)	16-20867	Dep.(mc); $1.10(fs), $0.80(mf) OTS
71958-RD	16-20979	Dep.(mc); $1.10(fs), $0.80(mf) OTS
71999	16-20868	Dep.; $3.50(OTS)
72199	16-20317	Dep.; $1.60(fs), $0.80(mf) OTS
73119	16-20565	Dep.; $0.50(OTS)
73476	16-20953	Dep.; $0.50(OTS)
HW-SA–		
2218	16-20964	Corrosion 18: 224t-9t(1962)
2583	16-21034	Dep.(mc); $12.00(fs), $5.03(mf) OTS
IA–	**(Non-AEC)**	
690	16-20318	Dep.(mc)
731	16-20355	Dep.(mc)
IDO–		
14574	16-20534	Dep.; $1.25(OTS)
14583	16-20535	Dep.; $1.25(OTS)
16698	16-21349	Dep.; $1.25(OTS)
16760	16-21839	Dep.; $1.25(OTS)
16780	16-21719	Dep.; $1.00(OTS)
IFA-DF–	**(Rumanian)**	
15	16-20922	Dep.(mc)
IFA-FT–	**(Rumanian)**	
40	16-21348	Dep.(mc)
IFA-TV–	**(Rumanian)**	
14	16-20566	Dep.(mc)
IP–	**(Non-AEC)**	
467	16-21008	See AD-263483
IS–		
366	16-21508	p.291-2 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961", New York, Academic Press Inc., 1961
391	16-21185	Phys. Rev. 126: 1275-82(1962)
ISS–	**(Italian)**	
61/7	16-20635	Dep.(mc)
61/17	16-20636	
JAERI–	**(Japanese)**	
1030(Suppl.)	16-20637	Dep.(mc)
JINR–	**(Russian)**	
D-820	16-21264	Dep.(mc)
D-870	16-20638	Dep.(mc)
P-869	16-20639	Dep.(mc)
JPRS–	**(Non-AEC)**	
13644	16-20132	OTS
JÜL–	**(German)**	
32-RC	16-20356	Dep.(mc)
K–		
1476(Rev.1)	16-20319	Dep.; $0.75(OTS)
KAPL-M–		
ECH-8	16-21814	Dep.(mc); $5.60(fs), $1.79(mf) OTS
PF-6	16-21720	Dep.(mc); $2.60(fs), $1.01(mf) OTS
LA–		
2677	16-21848	Dep.; $1.50(OTS)
LAL–	**(French)**	
1010	16-21646	Dep.(mc)
1021	16-21647	Dep.(mc)
LAMS–		
2697	16-20640	Dep.; $0.50(OTS)
MCW–		
1472	16-20525	Dep.; $1.50(OTS)
MND-C–		
2500-2	16-21721	$14.00(fs), $6.47(mf) OTS
MND-P–		
2483-S	16-21127	Dep.; $1.00(OTS)
MPR-XIII–		
4-62	16-20593	See TID-15637
MRL–	**(Non-AEC)**	
118	16-21128	
MTL–	**(Non-AEC)**	
2350	16-20807	See NP-11694
MURA–	**(Misc.)**	
634	16-21648	Dep.; $0.50(OTS)
635	16-20929	Dep.; $0.50(OTS)
NAA-SR–		
6267	16-21035	Dep.; $1.75(OTS)
6376	16-20806	Dep.; $0.75(OTS)

Report No.	Abstract No.	Availability
6878	16-21722	Dep.; $0.50(OTS)
6986	16-20320	Dep.; $0.50(OTS)
NAS-NRC–	(Non-AEC)	
Pub-974	16-21431	$2.00(NAS)
NAS-NS–	(Misc.)	
3106	16-20469	Dep.; $0.50(OTS)
NBS-C–	(Misc.)	
488(Sect.3)*	16-20357	$0.60(GPO)
488(Sect.4)*	16-20358	$0.45(GPO)
NDA–	(Misc.)	
2134-3	16-21723	Dep.(nc); $9.10(fs), $3.23(mf) OTS
NIRL-R–	(British)	
12	16-21649	Dep.; $1.26(BIS)
NLCO–		
842	16-20993	Dep.; $1.50(OTS)
NNI–	(Misc.)	
2104	16-20954	Dep.(nc); $3.60(fs), $1.25(mf) OTS
2105	16-20955	Dep.(nc); $1.60(fs), $2.80(mf) OTS
9235*	16-21036	
NP–	(AEC File No. for Non-AEC Reports)	
10640(Suppl.II)	16-20956	OTS
11530	16-20359	
11533	16-20567	
11537	16-20043	
11600	16-21265	
11602	16-21350	Dep.
11603	16-20814	
11604	16-20470	
11606	16-20044	Dep.(nc)
11608	16-20321	Dep.(nc)
11611	16-20045	
11614	16-21037	
11616	16-20641	
11621	16-20994	
11624	16-21650	
11640	16-21129	
11643	16-21130	
11647	16-21131	
11649	16-21665	
11651	16-21351	
11652	16-21132	
11653	16-20869	
11655	16-21093	
11657	16-21692	
11658	16-21238	
11663	16-20642	
11665	16-21038	
11667	16-21352	
11671	16-21039	
11677	16-20957	OTS
11680	16-21266	Dep.(nc)
11681	16-21353	
11682	16-21354	
11691	16-20643	Dep.(nc)
11694	16-20807	
11697	16-21355	Dep.(nc)
11698	16-21040	Dep.(nc)
11701	16-21724	Dep.(nc)
11702	16-20958	
11703	16-20959	
11706	16-21815	Dep.(nc)
11708	16-21094	
11741	16-20130	
11776	16-20995	Dep.(nc)
11789	16-20923	Dep.(nc)
11819	16-21693	
NP-tr–	(AEC File No. for Non-AEC Translations)	
886	16-21143	Dep.(nc); $3.60(fs), $1.16(mf) JCL
893	16-20363	Dep.(nc); $3.60(fs), $1.16(mf) JCL
894	16-20650	Dep.(nc); $2.60(fs), $1.04(mf) JCL
895	16-20325	Dep.(nc); $1.60(fs), $0.80(mf) JCL or OTS
901	16-21050	Dep.(nc); $1.60(fs), $0.80(mf) JCL
904	16-20879	Dep.(nc); $2.60(fs), $0.98(mf) JCL
NUS–		
107	16-21816	See NYO-2482
NYO–		
2482	16-21816	Dep.; $3.50(OTS)
2666	16-21356	Dep.(nc); $4.60(fs), $1.49(mf) OTS
7831	16-20815	Dep.(nc); $16.00(fs), $7.58(mf) OTS
9485	16-20471	Dep.; $0.75(OTS)
9531	16-20816	Dep.; $1.50(OTS)
9751	16-21393	Nuclear Phys., 32: 430-51(1962)
9934(Vol.III) Ext.	16-20870	Dep.(nc); $2.60(fs), $1.10(mf) OTS
10289	16-20360	Dep.(nc); $14.00(fs), $6.47(mf) OTS
ORNL–		
2712	16-20536	Dep.; $2.25(OTS)
3199(Add.)	16-20930	Dep.; $0.50(OTS)
3225	16-20960	Dep.; $0.75(OTS)
3274	16-21095	Dep.; $2.60(fs), $0.86(mf) OTS
ORNL-TM–		
167(Rev.)	16-20931	Dep.(nc); $1.10(fs), $0.80(mf) OTS
177	16-20537	Dep.(nc); $8.60(fs), $2.96(mf) OTS
186	16-20538	Dep.(nc); $1.10(fs), $0.80(mf) OTS
246	16-20539	Dep.(nc); $1.10(fs), $0.80(mf) OTS
PAN–	(Polish)	
220/I-A	16-21614	p.729-30 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961", New York, Academic Press Inc., 1961
269/I-A	16-20871	Dep.(nc)
PATENTS	(British)	3s. 6d. each, U. K. Patent Office
895,297	16-20690	
897,416	16-21834	
897,421	16-21843	
897,443	16-21745	
897,444	16-20621	
897,445	16-21746	
897,446	16-21747	
897,447	16-21835	
897,448	16-21748	
897,449	16-21749	
897,450	16-21750	
897,451	16-21751	
897,452	16-21752	
897,453	16-21753	
897,454	16-21754	
897,455	16-21755	
897,456	16-21756	
897,457	16-21757	
897,458	16-21758	
897,483	16-21836	
897,499	16-21759	
897,534	16-21760	
897,689	16-21002	
897,723	16-21761	
897,748	16-20465	
897,793	16-20531	
897,808	16-20310	
897,852	16-20691	
897,862	16-21762	
897,866	16-20622	
897,884	16-21763	
897,889	16-21764	
897,937	16-20811	
898,013	16-20577	
898,015	16-20524	
898,022	16-21765	
898,047	16-20578	
898,052	16-21766	
898,141	16-20532	
898,192	16-20553	
898,215	16-21767	

Report No.	Abstract No.	Availability
898,219	16-20692	
898,259	16-20579	
898,332	16-21837	
898,350	16-21768	
898,352	16-20623	
898,434	16-21769	
898,503	16-21689	
898,628	16-20580	
898,644	16-20581	
898,712	16-21770	
898,758	16-21771	
898,849	16-21772	
898,894	16-21773	
898,895	16-21774	
899,078	16-21775	
899,084	16-20693	
899,095	16-20624	
899,175	16-21776	
899,194	16-21777	
899,224	16-21778	
899,284	16-20311	
899,335	16-21779	
899,406	16-20533	
899,410	16-21780	
899,453	16-21003	
899,683	16-20918	
899,728	16-21781	
899,745	16-21782	
899,747	16-21783	
899,851	16-21784	
899,867	16-21785	
899,971	16-20694	
PATENTS	**(U. S.)**	**$0.25 each, U. S. Patent Office**
3,028,326	16-21004	
3,028,327	16-21786	
3,028,330	16-21005	
3,028,490	16-20695	
3,036,891	16-20927	
3,036,961	16-20969	
3,036,964	16-21787	
3,036,965	16-21838	
3,036,966	16-20582	
3,037,067	16-20583	
3,037,115	16-20919	
3,037,116	16-20920	
3,037,117	16-20584	
3,037,118	16-20696	
3,037,120	16-21788	
3,037,841	16-20554	
3,038,074	16-20697	
3,038,075	16-20698	
3,038,076	16-20699	
3,038,078	16-20700	
3,038,115	16-20701	
3,038,787	16-20585	
3,038,824	16-20970	
3,038,843	16-20921	
3,038,846	16-21789	
3,038,847	16-21790	
3,038,995	16-20702	
3,038,999	16-20586	
3,039,000	16-21006	
3,039,001	16-20587	
3,039,018	16-20588	
3,039,046	16-20703	
3,039,047	16-20704	
3,039,049	16-20705	
PATENTS	**(U.S.S.R.)**	
136,827	16-20880	For French translation see CEA-tr-R-1572
PG-Report-	**(British)**	
122	16-20322	Dep.; $0.49(BIS)
312	16-20323	Dep.; $0.35(BIS)
PNE-		
105P	16-20808	Dep.; $0.75(OTS)
116F	16-20046	Dep.; $0.75(OTS)
126F	16-20817	Dep.; $0.50(OTS)
127F	16-20047	Dep.; $2.25(OTS)
128F	16-20872	Dep.; $0.50(OTS)
133F	16-20873	Dep.; $0.75(OTS)
134F	16-20048	Dep.; $0.75(OTS)
PST-CAT-	**(Misc.)**	
89a*	16-20362	See AEC-tr-4434
PUC-		
1961-41	16-21578	p.553-4 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961
1961-55	16-21236	Phys. Rev. 126: 1580-1(1962)
PWAC-	**(Misc.)**	
139	16-21725	Dep.(nc); $9.60(fs), $3.68(mf) OTS
Q-B-	**(Non-AEC)**	
1933-1A2	16-20958	See NP-11702
R-	**(Misc.)**	
195*	16-21692	See NP-11557
60-CDE-01-03*	16-20625	See AD-265927
RADC-TR-	**(Non-AEC)**	
61-132	16-21357	OTS
RAE-Lib-	**(British)**	
Trans-971	16-21269	For translation see FTD-TT-61-23
RC-	**(Misc.)**	
164*	16-21015	See AD-266116
173*	16-20971	See AD-266150
RISÖ-	**(Danish)**	
35	16-21666	Dep.(nc)
RME-		
4517	16-20818	Dep.; $0.50(OTS)
4521	16-20819	Dep.; $0.50(OTS)
4568	16-20820	Dep.; $0.50(OTS)
RRL-	**(Misc.)**	
79	16-20472	Dep.(nc); $2.60(fs), $0.83(mf) OTS
RT/ING-	**(Italian)**	
(62)2	16-21724	See NP-11701
SB-	**(Non-AEC)**	
61-35(Suppl.II)	16-20956	See NP-10640(Suppl.II)
62-8	16-20957	See NP-11677
SC-	**(Misc.)**	
4596(RR)	16-20049	Dep.; $4.00(OTS)
4673(RR)	16-20874	Dep.; $0.75(OTS)
4853(RR)	16-20821	Dep.; $0.50(OTS)
SERL-TR-	**(British)**	
M-61	16-21358	
SI-Publ-	**(Norwegian)**	
338	16-21021	See ARL-240
SIT-P-	**(Misc.)**	
53*	16-21651	OTS
59	16-21667	See TID-15504
STI-PUB-	**(International Atomic Energy Agency)**	
34(Vol.II) (p.269-90)	16-20473	For translation see AEC-tr-5082
42(Vol.I)	16-20706	$11.00(IAEA)
42(Vol.II)	16-20757	$8.00(IAEA)
STR-TR-	**(Non-AEC)**	
60-0000-02166	16-20626	See AD-269307
TDR-	**(Non-AEC)**	
594(1208-01)TR-4	16-21658	See AD-265829
TID-		
3911	16-21133	Dep.; $0.75(OTS)
7630	16-21817	Dep.; $2.25(OTS)
14844	16-21726	Dep.; $1.00(OTS)
14978	16-21818	Dep.; $2.75(OTS)
15034	16-20909	Dep.; $2.50(OTS)
15054	16-20924	Dep.; $0.50(OTS)

Report No.	Abstract No.	Availability
15373	16-21819	Dep.; $0.75(OTS)
15417	16-21652	Dep.(mc); $1.60(fs), $0.80(mf) OTS
15436	16-21820	Dep.(mc); $2.60(fs), $0.98(mf) OTS
15473	16-21727	Dep.(mc); $3.60(fs), $1.31(mf) OTS
15502	16-21821	Dep.(mc); $5.60(fs), $1.88(mf) OTS
15504	16-21667	Dep.(mc); $6.60(fs), $2.27(mf) OTS
15637	16-20593	Dep.(mc); $1.60(fs), $0.80(mf) OTS
15639	16-21134	$6.60(fs), $2.15(mf) OTS
15661	16-20324	$3.60(fs), $1.31(mf) OTS
15663	16-21041	Dep.(mc); $3.60(fs), $1.25(mf) OTS
15692	16-21359	Dep.(mc); $5.60(fs), $1.79(mf) OTS
15702	16-20644	Dep.(mc); $3.60(fs), $1.40(mf) OTS
15706	16-21135	Dep.(mc); $3.60(fs), $1.31(mf) OTS
15708	16-21136	Dep.(mc); $5.60(fs), $1.94(mf) OTS
15742	16-20645	Dep.(mc); $7.60(fs), $2.36(mf) OTS
15788	16-20361	Dep.(mc); $1.60(fs), $0.80(mf) OTS
THCC(Con)–	**(Coradion)**	
18	16-21331	See AERE-R-4019
THCC(UK)–	**(British)**	
47	16-21331	See AERE-R-4019
TO-B–	**(Non-AEC)**	
61-39	16-21693	See NP-11819
TRG-Inf.–	**(British)**	
Ser-42	16-20542	Dep.(mc); $1.10(fs), $0.80(mf) JCL or OTS
TRG-Report–	**(British)**	
261	16-20646	Dep.; $0.42(BIS)
UCRL–		
5667-T	16-20944	Quart. Appl. Math. 18: 301-3(1960)
6305	16-21822	Dep.; $1.25(OTS)
6556-T	16-21463	p.65-82 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961
6779	16-21137	Dep.; $2.75(OTS)
6809	16-21138	Dep.; $0.50(OTS)
6818	16-20875	Dep.; $0.50(OTS)
9446	16-20245	p.421-42 of "Medical and Biological Aspects of the Energies of Space"
9692	16-20677	Nuovo cimento (10), 23: Suppl. No. 1, 1-16(1962)
9758	16-21518	p.311-12 of "Proceedings of the Rutherford Jubilee International Conference, Manchester, 1961." New York, Academic Press Inc., 1961
9864 & Rev.	16-21325	Phys. Rev. 126: 1567-71(1962)
9875(Vol.2)	16-21267	Dep.; $1.50(OTS)
9934	16-20495	J. Am. Chem. Soc., 84: 2115-21(1962)
10023	16-20305	Dep.; $4.00(OTS)
10048	16-20540	Dep.; $2.00(OTS)
10110	16-20932	Dep.; $2.00(OTS)
10125	16-21360	Dep.; $2.00(OTS)
10140	16-21268	Dep.; $0.50(OTS)
UCRL-Trans–		
804(L)	16-21226	Dep.(mc); $1.60(fs), $0.80(mf) JCL
817	16-20379	Dep.(mc); $3.60(fs), $1.31(mf) JCL
822(L)	16-21363	$1.60(fs), $0.80(mf) JCL or OTS
825	16-21270	Dep.(mc); $1.10(fs), $0.80(mf) JCL or OTS
UNC–		
1001	16-20961	Dep.(mc); $1.60(fs), $0.80(mf) OTS
UNI-TR–		
EE-73	16-21139	Dep.(mc); $3.60(fs), $1.16(mf) OTS
UR–		
575	16-20131	Dep.; $0.75(OTS)
605	16-20876	Dep.; $3.50(OTS)
USNRDL-TR–	**(Non-AEC)**	
436	16-20594	
WADD-TR–	**(Non-AEC)**	
60-698(Pt.I)	16-21849	OTS
WAL-TR–	**(Non-AEC)**	
851.2/1	16-21042	
WAPD-PWR–		
TE-70	16-21823	Dep.(mc); $1.60(fs), $0.80(mf) OTS
TE-89	16-21824	Dep.(mc); $1.10(fs), $0.80(mf) OTS
WAPD-TM–	**(Misc.)**	
273	16-20933	Dep.; $1.50(OTS)
315	16-20934	Dep.; $0.50(OTS)
WCAP–	**(Misc.)**	
4121	16-21825	Dep.(mc); $1.60(fs), $0.80(mf) OTS
WT–	**(Misc.)**	
1485	16-20647	Dep.; $0.50(OTS)
XDC–		
60-1-141	16-21361	Dep.(mc); $1.10(fs), $0.80(mf) OTS
60-1-158	16-20595	Dep.(mc); $1.60(fs), $0.80(mf) OTS
60-1-211	16-21728	Dep.(mc); $4.60(fs), $1.67(mf) OTS
60-2-76	16-21335	Dep.(mc); $2.60(fs), $0.95(mf) OTS
60-2-116	16-21096	Dep.(mc); $3.60(fs), $1.19(mf) OTS
60-3-211	16-20935	Dep.(mc); $7.60(fs), $2.51(mf) OTS
XDCL–		
59-2-722	16-20648	Dep.(mc); $1.10(fs), $0.80(mf) OTS
Y–		
1386	16-20877	Dep.; $1.00(OTS)

DEPOSITORIES OF USAEC REPORTS

In Countries Other than the U.S.

ARGENTINA
Buenos Aires, Comisión Nacional de Energía Atómica
AUSTRALIA
Canberra, Australian National Library
Sutherland, New South Wales, Australian Atomic Energy Commission
AUSTRIA
Vienna, Zentral Bibliothek der Physikalischen Institute der Universität
BELGIUM
Mol-Donk, Centre d'Etude de l'Energie Nucleaire
BRAZIL
Rio de Janeiro, Instituto Brasileiro de Bibliografia e Documentacao
São Paulo, Instituto de Energia Atomica, Cidade Universitaria São Paulo
BURMA
Rangoon, Union of Burma Applied Research Institute, Atomic Energy Center Library
CANADA
Hamilton, McMaster University
Ottawa, National Research Council Library
Vancouver, University of British Columbia
CEYLON
Colombo, University of Ceylon
CHILE
Santiago, Instituto de Fisica y Matematicas, Universidad de Chile
CHINA
Hsinchu, Taiwan, Free China, National Tsing Hua University
COLOMBIA
Bogota, Instituto De Asuntos Nucleares
COSTA RICA
San Pedro, University of Costa Rica Library
DENMARK
Risö, Danish Atomic Energy Commission
DOMINICAN REPUBLIC
Ciudad Trujillo, National Palace
ECUADOR
Quito, Escuela Politécnica Nacional
EGYPT
Cairo, Atomic Energy Commission
EL SALVADOR
San Salvador, Universidad de El Salvador, Biblioteca de Energia Nuclear
ENGLAND
Birmingham, Central Library
Bristol, Central Library
Kingston upon Hull, Central Library
Leeds, Central Library
Liverpool, Central Library
London, Central Library, Acton
London, Science Museum Library, South Kensington
Manchester, Central Library
ENGLAND (CONT.)
Newcastle upon Tyne, Central Library
Nottingham, Public Libraries
Sheffield, Central Library
FINLAND
Helsinki, Teknillinen Korkeakoulun Kirjasto
FRANCE
Gif-sur-Yvette, Centre d'Etudes Nucléaires de Saclay
Paris, Académie des Sciences
GERMANY
Berlin, Hahn-Meitner-Institut für Kernforschung Berlin
Frankfurt/Main, Gmelin-Institut
Munich, Technische Hochschule, Bibliothek
GHANA
Accra, University College of Ghana
GREECE
Athens, Greek Atomic Energy Commission
GUATEMALA
Guatemala, Comisión Nacional de Energía Nuclear
HAITI
Port au Prince, University of Haiti
HONDURAS
Tegucigalpa, Comisión Hondureña de Energía Atómica
ICELAND
Reykjavik, University of Iceland, Atomic Energy Library
INDIA
Bombay, Department of Atomic Energy
INDONESIA
Bandung, Java, Bandung Institute of Technology
Djogjakarta, Java, Science Faculty, Gadjah Mada University
IRAN
Tehran, Tehran University Center for Nuclear Studies
IRAQ
Baghdad, Iraqi Atomic Energy Commission
IRELAND
Dublin, University College
ISRAEL
Rehovoth, Israel Atomic Energy Commission
ITALY
Casella, Centro di Studi Nucleari di Ispra del C.N.R.N.
Rome, Comitato Nazionale per le Ricerche Nucleari
JAPAN
Tokyo, Science Section, Diet Library
KOREA
Seoul, Office of Atomic Energy
LEBANON
Beirut, American University
LUXEMBOURG
Luxembourg, Ministry of Transport and Electricity
MEXICO
Mexico, D.F., Comisión Nacional de Energía Nuclear
NETHERLANDS
The Hague, Reactor Centrum Nederland
NEW ZEALAND
Wellington, Department of Scientific and Industrial Research
NORTHERN IRELAND
Belfast, City Library
NORWAY
Lillestöm, Institutt för Atomenergi
PAKISTAN
Lahore, West Pakistan, Atomic Energy Centre
PERU
Lima, Junta de Control de Energia Atomica
PHILIPPINE REPUBLIC
Manila, Philippine Atomic Energy Commission
POLAND
Warsaw, Biuro Pelnomocnika Rzadu do Spraw Wykorzystania Energii Jadrowej
PORTUGAL
Lisbon, Junta de Energía Nuclear
REPUBLIC OF SOUTH AFRICA
Pretoria, Atomic Energy Board Library
REPUBLIC OF THE CONGO
Leopoldville, Université Lovanium
SCOTLAND
Glasgow, Mitchell Library
SPAIN
Madrid, Junta de Energía Nuclear, Bibliotaca Documentación y Publicaciones, Ciudad Universitaria
SWEDEN
Stockholm, Aktiebolaget Atomenergi
SWITZERLAND
Zurich, Institut für Physik, Eidg. Technische Hochschule
THAILAND
Bangkok, Office of the Thai Atomic Energy Commission, Department of Science
TURKEY
Ankara, Turkish Atomic Energy Commission, Atomic Energy Library
URUGUAY
Montevideo, Comision Nacional de Energia Atomica
VENEZUELA
Caracas, Instituto Venezolano de Investigaciones Cientificas
VIET-NAM
Saigon, Office of Atomic Energy
YUGOSLAVIA
Belgrade, Federal Commission for Nuclear Energy

In International Agencies

AUSTRIA
Vienna, International Atomic Energy Agency
BELGIUM
Brussels, La Bibliotheque EURATOM
FRANCE
Paris, European Nuclear Energy Agency, O.E.C.D.
ITALY
Ispra, EURATOM Research Center
SWITZERLAND
Geneva, United Nations Library
UNITED STATES
Washington, D. C., Inter-American Nuclear Energy Commission

UNITED STATES
GOVERNMENT PRINTING OFFICE
DIVISION OF PUBLIC DOCUMENTS
WASHINGTON 25, D. C.

OFFICIAL BUSINESS

PENALTY FOR PRIVATE USE TO AVOID
PAYMENT OF POSTAGE, $300
(GPO)